The Chemical Age

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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1926-1927

THE year that has just closed will long be recalled as one of the most notable in the history of British Chemical Industry. Two events alone would have made it memorable in any case—the prolonged coal strike and the formation of Imperial Chemical Industries, Ltd. The former is discussed from different points of view in this issue. From every standpoint it remains a disaster, from which no single interest has gained anything, but from which national well-being has seriously suffered. If there is any soul of goodness in the blindfold policy which inspired and directed it, it is to be found in the complete failure of the forces of disorder and in the national sanity which carried the country safely through the crisis. The costly experience has impressed on all the imperative need of assured industrial peace, and of co-operation on the part of all for the common good. One incidental by-product of distinct value remains in the Report of the Coal Commission. In this document the historical, scientific, and economic aspects of the coal industry are reviewed with unusual thoroughness and knowledge. It reveals much that urgently requires to be done to place the fundamental key industry on a better national basis, and indicates the supreme part that applied science must take in the process. The owners' indifferent attitude towards research in the past must be counted as not the least of the factors that have hampered progress. The formation of Imperial Chemical Industries, Ltd., came upon the public and indeed upon the chemical industry as a dramatic surprise. Rapidly as the idea has been carried into effect, there has been no sign of haste or uncertainty. The great scheme, directed by clear and able minds, has gone through with astonishing smoothness, and the largest confederation of chemical interests the Empire has known is already in being. The shareholders in the four constituent companies are steadily exchanging their holdings for I.C.I. shares, as every authority expected them to do. Some are holding on temporarily to the old shares in the expectation of some possible gain, but this attitude cannot last for long. Already the merger shares stand well on the Stock Exchange, and their potential worth probably far exceeds the present figure.

Other Noteworthy Developments

Apart from the two great factors mentioned, there have been many noteworthy developments in other directions. The principal of these has been in the field of fuel. Here we appear to be at the beginning of a new epoch. The studies of continental experts like Bergius, Fischer, and Patart, the research work on coal that is steadily proceeding in this country, not only at the Fuel Research Station but at Teddington and various university and technical centres, and the corresponding investigations in the United States, constitute a concentrated attack on the whole science and technology of fuel. Certain definite starting points have been established and already certain probable lines of advance have become apparent. But present theories may, as usual, have to be modified or reconstructed as the result of experimentation, and to speak of any one method as the method of the future is, at this stage, futile. What can be said with conviction is that the chemical researcher and technologist have obtained a sound first grip of the problem, and are settling down to work. The result sooner or later will be what it has always been when science takes up such tasks in earnest. The problems will be mastered, and at present no one can fix a limit to the ultimate developments.

Another field in which important advances may yet be added to the astonishing achievements of the past few years is that of artificial fertilisers, to return to an older term not so often used to-day. The synthetic nitrogen industry is the chemical marvel so far of this century. From the production from the air of simple substances like sulphate of ammonia we are proceeding to compound nitrogen fertilisers of a far more complete character, and the Germans have recently put on the market what is claimed to be a

complete fertiliser, Nitrophoska. The conditions of soils, climates, and plant life, however, vary so enormously that no one form can satisfy all needs, any more than one form of food can satisfy all human beings. The adaptation of special fertilisers to special conditions opens up an enormous field, and research has much before it yet unexplored. In this country every satisfaction may be felt with the progress made. The Billingham works of Synthetic Ammonia and Nitrates, Ltd., have achieved within a few years results that no one would have ventured to prophesy over so short a period. The Sulphate of Ammonia Federation has done excellent work in the past in organising the ammonium sulphate industry of this country and in undertaking organised propaganda throughout the world. The recent formation of Nitram, Ltd., as the future sales and propaganda agency, not only for sulphate but for other new forms of nitrogenous fertilisers, marks an important extension of the British field of operations, and indicates ample confidence in the future.

A Survey of the Industry

Coming to more sectional aspects of British chemical industry, our readers may be referred to the series of review articles published in this issue—by Sir William Alexander, M.P., and Mr. W. J. U. Woolcock, on the British chemical trade of the year, by Dr. E. B. Maxted and Dr. F. A. Freeth on developments in the nitrogen industry, by Mr. Ronald S. Horsfall on the progress of British dyestuffs, by a leading authority on the state of the fine chemical industry, by Mr. P. Parrish on the main features of the heavy chemical industry, and by our Patents Correspondent on the leading chemical inventions of the year, together with the notes on the various activities of the chemical and allied societies.

The increasing importance of research as a vital condition of keeping pace with other nations and as a means of opening up new industrial activities is convincingly shown in Sir William Alexander's general survey of chemical industry in 1926. Chemical trade to-day, he points out, reflects the adventurous and resourceful technique which is being developed so vigorously in Germany, France, the United States, Canada, and this country. The use of high pressures and temperatures, far exceeding what was thought possible a few years ago, the better control and understanding of the action of catalysts, the study of the phenomena of surface tension and viscosity, are some of the chemical methods of making old products in new ways or of making in bulk new products for which a need existed or has been created. The detailed list of what are almost new industries arising out of new chemical technique, such as synthetic methyl alcohol, nitrocellulose lacquers, rubber accelerators, etc., makes an almost startling impression of the way in which the modern chemist and technologist between them are re-shaping industry, and always for the advantage of the consumer.

From a somewhat different point of view, and approaching the subject in a cautious and critical analytical spirit, we find the conclusions of Mr. W. J. U. Woolcock to point in the same direction. He deals out of adequate first-hand knowledge and with complete frankness with the conditions during the past year in various important branches of chemical industry; he shows the adverse influences in which the industry has been able to hold its own, and also how in more favourable circumstances it is likely to make good progress in the coming year. And in his case, again, the confidence in the future is largely based on the fuller recognition and activity of research.

Mr. P. Parrish, in his informed and incisive study of the heavy chemical industry, more especially from the technical standpoint, is so confident of the future as to predict that "given freedom from industrial troubles, the volume of trade in the heavy chemical industry will, if not in 1927, certainly in 1928, eclipse any previous record. A slow metamorphosis has been proceeding during the last few years; it has now culminated in new processes and new activities, and it only remains for employers and employees to co-operate judiciously to consummate the results of research and sound commercial policies which have been initiated." From the technological side there could be no better judge of where we stand. Incidentally, Mr. Parrish points out that in the ammonia industry, both synthetic and by-product, the use of sulphuric acid is declining in favour of the cheaper radicle anhydrite.

Fine Chemicals and Dyestuffs

No one interested in the progress of the British fine chemical industry can read without satisfaction the account of its present position contributed by a first-class authority. Not only is the range of products constantly being enlarged, not only are British brains and British hands producing new compounds and substances of great importance, but the reputation of British fine chemicals for purity and trustworthiness continues steadily to advance and is, in fact, replacing the old German reputation. Ten years ago, the high reputation of German fine chemical products was one of the greatest handicaps to the newly developing British industry; to-day the handicap has been more than wiped off. According to the testimony of a Vienna medical journal, German fine chemicals and chemical preparations have reached their twilight, and in cases like that of insulin continental doctors are insisting on the ingredients of a prescription being of British production. All this marks a change which must be very gratifying to those who have worked so hard to justify their position and which entitles them to the fullest confidence and support of people at home.

Of the British dyestuffs industry Mr. Ronald S. Horsfall, chief colourist to the British Dyestuffs Corporation, supplies an account of brilliant scientific and technical achievement, coupled with steadily improving commercial organisation. On the one side, never was research more active in the organic chemical industry. Chemicals hitherto spoken of in pounds promise to be quoted in tons in the very near future. Cheap organic solvents may provide new liquid media which may in turn lead to a new dyestuff technique in manufacture and application. And so on with nitrocellulose varnishes, rubber accelerators, and other substances. One of the newer viscose companies is said to have a process whereby a silk is obtained possessing much greater tensile strength when wet than has hitherto been the case. New dyestuffs made solely to meet artificial silk problems are constantly appearing, and a new series of British manu-

facture in this pre-eminently British field are to appear on the market in the early months of 1927. When one considers what the British dyestuffs industry was as recently as ten years ago, Mr. Horsfall's story reads more like a romance than the severely scientific statement it really is.

It is a pleasure once more to publish the learned and singularly clear account of developments in the nitrogen industry that Dr. E. B. Maxted once more contributes. Physical chemistry and novel methods of attack, such as the use of extremely high pressures, are paving the way not only for the manufacture of ammonia but also for the production of other compounds, in the first rank of which stands synthetic methyl alcohol. Progress has been such that high pressure equipment has to a large extent become simplified and standardised, and the construction of such plant is rapidly becoming a well-known, if special, branch of general engineering. A notable feature in the field of nitrogen fixation is the extent to which high pressure processes are displacing those carried out at high temperatures. Dr. Maxted's review of new processes or of modifications of existing ones is one that every student who desires to keep pace with ever-advancing technique will be glad to possess. Dr. F. A. Freeth's shorter paper on synthetic nitrogen and food supplies deals in a more general way with national and international aspects of the subject.

German Patent Activity

The careful analysis by our capable Patents Correspondent of the more important chemical patents taken out during the year may be commended to all students of new ideas. There is one matter of serious import that his review discloses, namely the steady increase in the proportion of patents taken out under the International Convention arrangements, that is, applications made in this country and claiming priority of date in virtue of an earlier application in a foreign country. These inventions are necessarily owned almost without exception by foreigners and four years ago were about half as numerous as those for which protection was sought here in the ordinary way. This proportion has risen until this year the number of inventions filed under the International Convention is at least equal to those patented as ordinary British applications. When one considers that perhaps half the latter are also of foreign origin and ownership, it will be seen that at least 75 per cent. of British chemical patents are owned abroad. Most of them, as may be expected, originate in Germany. Practically, in relation to so important a field as the hydrogenation of coal, again, the whole of the inventions have originated in Germany. While this does not discount the favourable reports of what has been done in this country during the year, it does supply a warning against any relaxation of research activity.

Taking the various contributions that appear in this issue, together with the records of the chemical and allied societies, the general conclusions are (1) that in a year of exceptional difficulty the position has been wonderfully well maintained, (2) that there is every prospect of a steady improvement in 1927, provided we are reasonably free from industrial strife, and (3) that whatever may have been our attitude towards research in the past, the ablest commercial leaders now count it an indispensable condition of existence, to say nothing of advance. It only remains to wish all our readers and friends at home and overseas a year of returning and steadily growing prosperity.

Books Received

HANDBOOK from the Colour Users' Association.

WALL CALENDAR from R. H. Kirkup and Co., Gateshead-on-Tyne.

POCKET DIARIES from the British Dyestuffs Corporation, Ltd., Scottish Dyes, Ltd., and Collins, Ltd.

BIOLOGY AND HUMAN LIFE. By Professor J. S. Huxley. (The Norman Lockyer Lecture, 1926.) London: The British Science Guild. Pp. 24. 1s.

The Calendar

Jan.		
3	Society of Chemical Industry (London Section): "Modern Developments in the Treatment of Sewage." J. H. Coste and Col. Butler. 8 p.m.	Burlington House, Piccadilly, London.
4–6	Optical and Scientific Instruments Exhibition.	Imperial College of Science and Technology, London.
6	Society of Dyers and Colourists (West Riding Section): "Soledon Colours (SDC) and their Development on Cotton and Wool." Professor F. M. Rowe.	Bradford.
6	Institution of the Rubber Industry (Birmingham): "Physical Tests and their Significance." A. W. T. Hyde.	Grand Hotel, Birmingham.
7	Society of Chemical Industry (Manchester Section): Short Papers by members. 7 p.m.	16, St. Mary's Parsonage, Manchester.
10	Institution of the Rubber Industry (London Section): "Ageing of Raw and Vulcanised Rubber." G. Martin.	Engineers' Club, Coventry Street, London.
10	Institute of Metals (Scottish Section): Discussion on "The Value of Research." Professor J. H. Andrew. 7.30 p.m.	39, Elmbank Crescent, Glasgow.
11	Institute of Metals (Birmingham Section): "Forces Set Up in Strip Rolling." H. S. Caswell. 7 p.m.	Engineers' Club, Birmingham.
11	Institute of Metals (N.E. Coast Section): "Some Aspects of the Corrosion of Metals." U. R. Evans. 7.30 p.m.	Armstrong College, Newcastle-on-Tyne.
11	Institute of Chemistry (Manchester Section): "Air Pollution." Professor J. B. Cohen.	Manchester.
11	Institution of Petroleum Technologists. 5.30 p.m.	House of the Royal Society of Arts, John Street, Adelphi, London.
11	Society of Chemical Industry (South Wales Section): "Magnesium and its Alloys." W. R. D. Jones. 7.30 p.m.	Technical College, Cathays Park, Cardiff.
11	Society of Chemical Industry (Birmingham Section): "A Study of the Rotatory Dispersion of Certain Derivatives of Hydroxy-acids." C. E. Wood.	University Buildings, Edmund Street, Birmingham.
11	Co-ordinating Committee of The Staffordshire Iron and Steel Institute, The Birmingham Metallurgical Society and Institute of Metals: "Forces set up in Strip-Rolling." H. S. Caswell. 7 p.m.	Girls' High School, Dudley.
12	Society of Chemical Industry (Nottingham Section): "Liquid Fuel from Coal." Dr. King. 7 p.m.	University College, Nottingham.
13	Optical Society: Ordinary meeting. 7.30 p.m.	Imperial College of Science and Technology, London.
13	Oil and Colour Chemists' Association: "Cadmium Colours and their Application to the Paint Industry." H. W. D. Ward. 8 p.m.	8, St. Martin's Place, Trafalgar Square, London.

British Chemical Industry in 1926

I.—By Brig.-General Sir William Alexander, K.B.E., C.B., C.M.G., D.S.O., M.P.

THE Coal Strike was the most conspicuous and disturbing factor in industry generally in 1926. It was the result of crazy psychology, and it would be idle to deny its crippling effects in many directions, leading to losses which may prove to be greater in total than is at present realised.

The financial losses and sacrifices involved have fallen not least on the misguided strikers themselves, but good may come out of the lesson if employers and employees alike have realised, none too soon, in the national and individual interest, that close and harmonious co-operation for maximum output per man-hour alone will ensure competitive low cost and maximum wages.

It is satisfactory to record that on the whole the chemical industries of the country have come through in a way which reflects great credit on the foresight and courage of the management and the workers. Factories were kept going and demands were largely met, but basic stocks have been everywhere depleted and their replacement to a normal figure may well prove the starting point of increased activities and business.

The main features of the year are, however, to be found in directions which, if less spectacular, are of much greater moment, inasmuch as they are not accidental or spasmodic, but are the outcome of fundamental changes in outlook and performance.

The lag, so often deplored, between academic or pure research and the acceptance and concrete realisation of its results in industry, is getting less and less. It is only just to observe that research has itself gained from the better defined goals placed before it.

Chemical trade reflects in no uncertain manner the adventurous and resourceful technique which is being developed so vigorously in Germany, France, the United States of America, in this country, and in Canada. The use of high pressures and temperatures, the better control and understanding of the action of catalysts, a study of the phenomena of surface tension and viscosity, are among the weapons which the chemist is using to make old products in new ways and to make in bulk new products for which a need existed or has been created.

A few examples will illustrate these tendencies.

The use of high pressures has resulted in new syntheses of ammonia and methyl alcohol. The one must lead to cheaper formaldehyde, while the other (ammonia) not only leads to nitrates, but to the direct synthesis of urea, now available as a fertiliser and used for synthetic resins and artificial (non-breakable) glass. Calcium carbide is not only a source of acetaldehyde and acetic acid, but also of butyl alcohol, as of calcium cyanamide used as a fertiliser and capable of conversion into urea.

Fermentation processes have led to acetone and butyl alcohol at much reduced cost, both in increasing demand as solvents, and control is such that the proportions can be varied to fit in with the greater demand.

Newer Methods: Better Products

These newer methods, leading to cheaper and purer products, make it necessary for the older industries, such as that of wood distillation, to re-examine and improve their processes if they are to survive.

The control of the viscosity of nitrocellulose has led to a new lacquer industry, which requires solvents, plasticisers, and softeners. Laboratory curiosities or rarities are now being made in large and increasing quantities as the lacquers find application in the motor industry. It cannot be long before products capable of application easily by brush, as well as by spraying, are evolved, when there will be a further great development in the domestic use of lacquers. The solvents and softeners are to be found in various classes of organic compounds, such as alcohols, esters, ethers, and ketones.

Of particular interest to-day from the point of view of the chemical trade are butyl and amyl alcohol (fusel oil) and their acetates. Amyl alcohol is now being successfully and profitably produced synthetically in America. Others to be mentioned are ethyl acetate, of which very large quantities are made in America; ethyl lactate, which is a solvent with special advantages; diethyl phthalate, as a plasticiser; diacetone alcohol, the French "Ketol," which is a mixture of ketones obtained from sawdust, the glycol ethers and bodies of the type of cyclo-hexyl acetate.

New solvents are also coming in for the preparation of lacquers from synthetic resins, including those obtained from urea. There is a continual demand for non-inflammable solvents and for scrubbing agents for gases, that is, for the chlorinated derivatives of acetylene and for hydrogenated naphthalenes.

The study of surface tension has rendered possible the use of organic products as wetting-out and dispersing agents, emulsifiers, and for froth flotation.

Among others, potassium xanthate, thio-carbanilide, and even such a drug on the market as ortho-toluidine, are used in increasing quantities. It is not impossible that methods of froth flotation may yet find an economic application in the treatment of dirty coal.

New dyestuffs for new fabrics, such as Rayon and Celanese, and an extended use of dyestuffs in medicine and surgery are also to be noted, as also a growing demand for auxiliaries in the dyeing industry.

Organic synthetic chemical products are becoming more and more available for assisting the farmer and the grower to fight disease and insect and fungus pests, and the manufacturer to combat moth and mildew.

There has been during the year a steady demand for such rubber accelerators as have proved their value, such as the substituted Guanidines and Thio-carbamates, and the ever-increasing extended life of the motor tyre is one of the useful results.

The recently announced syntheses of Thyroxin and of the active principles of musk and civet are brilliant examples of the way in which research is constantly increasing the scope of some branch of chemical manufacture.

New uses for known substances are to be observed in the employment of carbon dioxide snow for refrigeration and of glycol as an anti-freeze. There are two other directions in which development work is continuing. One is the working up of waste material into some useful product. There are many recent examples, but that of Furfural will serve. Furfural can now be obtained in large quantities from bran, wood-husks, etc., and is probably the cheapest aldehyde commercially available. It can be used for synthetic resins and is an excellent solvent for nitro-cellulose.

Prevention of Waste

The other direction is the prevention of waste—whether of energy or material—combined with a desire to make each country as independent as possible in the matter of essential products.

There is an extraordinary technical effort to-day to find the least wasteful use of coal. The high pressure hydrogenation of coal, the complete gasification of coal, and the syntheses from the products of alcohols and other organic products, the low temperature distillation of carbonaceous matter of all kinds, are being studied and all hold out promise of great commercial achievement.

These developments are outside of the present brief survey, except in so far as their products come on the chemical markets to supply a demand, or as products for which an outlet will have to be found.

Coal is the one raw material this country possesses in abundance, and it is not fantastic to imagine that coal will yield in the comparatively near future, through the proper treatment of a material like low temperature tar, such supplies of petrol and oil as will abolish our dependence on imports.

Nothing has been said of the heavy chemical industry, for it was desired to lay emphasis on the most marked feature of the year, namely, the greatly increased use of organic substances in industry. It is perhaps sufficient to say that the heavy chemical industry has more than held its own in the face of ever keener world competition.

Towards this end strong and soundly organised combinations for pooling resources—such as the recently formed corporation for linking up explosives, chemicals, and dyestuffs under "Imperial Chemical Industries, Ltd."—is all to the national good, and must be the forerunner of similar co-operation in other large key industries.

In spite of its many difficulties 1926 will be remembered as having furnished the chemical trade with new and varied opportunities for providing users with the products of industry in research, and research in industry.

II.—By W. J. U. Woolcock, C.B.E.

(General Manager of The Association of British Chemical Manufacturers.)

In discussing the state of chemical industry, prophecy based on the events of such an abnormal year as 1926 is necessarily of little value, unless the accidental influences on trade can be segregated from the specific factors bearing upon the chemical industry at the present time. Nor must the fact be overlooked that we are now passing through a very transitory stage in the post-strike period, and that the position is further complicated by the incidence of holidays and " end of the year " feeling.

Effects of the Strike: Sulphur Acid Industry

The reader cannot have failed to obtain by now a very fair idea as to the extent to which the coal stoppage affected chemical industry during the past year, and it is only necessary to mention the deep-rooted influence of the fuel producing industries in order that we may realise how far recovery and future progress are bound up with the future of the coalmining industry.

Indicative of the condition in most industries, by reason of its multiple uses, the sulphuric acid industry might be considered at this point. As this review is being written before accurate information with respect to the last three months of 1926 is available, the reader must understand that the phrases " this year " and " last year " refer respectively to the years ending September 30, 1926 and 1925. The reader should also understand that a ton of acid refers to a long ton of 70 per cent. monohydrate (123° Tw.) sulphuric acid.

The effect of the coal strike can very clearly be seen by the amount of acid used in the manufacture of sulphate of ammonia, which last year was slightly less than a third of a million tons, and this year slightly less than a quarter of a million tons, the whole of this decrease being due to the strike and the consequent closing of coke ovens and the use by gas companies of imported coal containing less nitrogen than the domestic fuel.

In spite of the greatly increased cost of manufacture caused by the strike, which is reflected in almost all the items going to make the total cost of manufacture, and also of the cost of freightage for both raw and finished material, it is satisfactory to be able to report that no increase in the sale price of the acid has taken place, and in fact the tendency, if anything, is downwards.

In all the heavy chemical industries where long experience has resulted in almost complete perfection of established processes, it is among the extraneous influences that we must look for the deciding factors as to whether sales at keenly competitive prices will be profitable or otherwise. Such factors include the two which have been most adverse during the year—fuel supplies (with regard to both cost and availability) and cost and facility of collection of raw material and distribution of the finished product.

An examination of the 1926 data for some of these heavy industries is apt to be misleading, for we find that export trade seems to have been little affected; indeed, in some cases, notably bleaching powder and ammonium chloride, there has been a definitely increased export trade compared with 1925. On the other hand, it must be remembered that for various economic reasons sales must be made almost irrespective of the difference between cost of production and market value; these heavy chemical industries, and sulphuric acid production more than the rest, depend for maximum efficiency on a production as near to capacity as possible, and it is necessary therefore to keep as near that ideal as possible, even at some financial cost.

Coal Tar Distillation and Derivatives

The paralysing effect of the strike on coal tar distillation is too obvious to need emphasis: first the shortage of supplies and later the inferior quality of tar from foreign coals have resulted in perhaps the most difficult year that the distillers have experienced. Most products have, of course, experienced a lively demand at rising prices, but as supplies were small and limited no appreciable gain resulted to the manufacturer in that way. Now, when conditions are easing with regard to supplies of raw materials, and prices are becoming very mobile, the distiller finds himself in a different but equally difficult position, which again is more complicated by the tendency to leave all but pressing orders till the New Year; and so the absence of forward orders and the limitation of present buying to very small parcels have restricted distillation to a minimum.

The industries dependent on tar distillation for raw material —dyestuffs, and fine chemical manufacture to a smaller extent—are experiencing equally difficult limitations. In the case of the former, demand fell off during the year as activity in the cotton and wool industries decreased, until manufacturers realised that it was only safe to draw from stock and wait until the termination of the strike before attempting to produce at pre-strike rates. Now, of course, with easing conditions with respect to raw materials, there will probably be increased output to fill the stock-room, but until the textile industries become distinctly more active there is not likely to be great prosperity in the dyestuffs industry.

Fine Chemicals

The root of the difficulty in the fine chemical industry is of rather a different nature. Apart from one or two chemicals, notably the derivatives of carbolic acid, production costs have only been affected by the strike to a minor extent, as fuel consumption and transport facilities do not occupy as significant a position as in the heavy chemical industries. On the other hand, the industry has this in common with all young industries such as dyestuffs, artificial silk, etc., manufacture, that ultra-rapid development is the only road to ultimate success. Such development, while necessarily affected by the coal strike in a minor way, has suffered more by the prolonged deliberations in connection with relevant legislation. This, too, may be coupled with the coal strike as one of the accidental features of the year, and it is only necessary to mention the directions in which progress has been affected.

First, then, trade has been confined to immediate requirements in those chemicals the position of which in List " H " is doubtful, and this has had a depressing effect on trade in the rest of the fine chemical manufacturers' products. Secondly, there has been in the case of chemicals that are likely to be introduced into the new list a process of organised dumping of foreign material that will have a marked effect on the future history of these chemicals.

The effect of the coal strike on other chemical industries is doubtful. Manufacturers of painters' materials have experienced quite a satisfactory demand, especially abroad, and probably the only result of the strike will have been a smaller amount of renovation carried out in the present year because of the general trade depression. Artificial silk manufacture has received a fillip by reason of the determined attempts to keep the Lancashire cotton mills running by the increased production of artificial silk-cotton mixtures, but this has been met in parts by imports of foreign yarn.

Estimate of Future Progress

It should now be possible to make a fair estimate of the actual progress that has been made in chemical industry during the year, and to obtain some idea as to what the future holds in view. There is one fact that will help us to form our opinions, namely that the effect of the strike on chemical industry has been less than could justifiably be expected as the result of such a prolonged disturbance. This leads to two further conclusions of the utmost importance in preserving the balance in our final consideration. In the first place, the industry has progressed absolutely, though not relatively; that is to say, there was a certain amount of progress made during the year which helped to write off part of the adverse effects of the strike; and arising out of this is the conclusion that under normal conditions there would in all probability have been a relative progress in trade instead of an absolute one.

It should also be possible to see the direction in which chemical industry has been tending to move during the year and so to look with some assurance into the future. On the whole, there was maturing during the first part of the year that progressive spirit which had been born at the end of the war, and which was for the first time unfettered by the bonds of post-war slumps. On the other hand, individual industries were not equally favoured. What may be called the raw

material industries saw prosperity only in the distant future, and in these cases we find that there has been little advance during the year, and that now the prospects are still more doubtful. In sulphuric acid manufacture, for instance, the raw materials consumed remained practically constant during the two years for which figures are available (September-September, 1924-25 and 1925-26), in which years approximately 47-48 per cent. of the acid manufactured was made from pyrites, of which 1 per cent. was domestic ore; about 23 or 24 per cent. was made from spent oxide, and a similar amount from brimstone, the balance of 5 or 6 per cent. being manufactured from the fumes resulting from the roasting of zinc concentrates in various parts of the Kingdom.

The plant capacity of the United Kingdom has not altered materially during the last two years. During last year about 61 per cent. of the plant was in operation, whereas this year the figure has fallen to 52 per cent. It is interesting to note that during the last quarter of the present year, when the full effect of the coal strike was felt, the amount of plant utilised fell to 33 per cent.

Superphosphate Industry

A very large consumer of sulphuric acid is the superphosphate trade, and the figures of the consumption of sulphuric acid by this industry and of the importation of superphosphate illustrate the difficult time through which the industry is passing :—

	This Year.	Last Year.
Acid used in superphosphate industry	213,500 tons	236,000 tons
Imports of superphosphate ..	128,400 tons	107,400 tons

Foreign competition, aided by more favourable natural circumstances, has been extremely severe, and the determined efforts of French manufacturers to push the development of the North African phosphate beds to the limit are likely to have a prolonged depressing effect on British manufacture. Nevertheless, it should be possible to hold the home market at least, and under normal conditions there should be a complete recovery in this direction.

Part of the decreased trade in by-product ammonium sulphate is due to the increasing preference for the more uniformly shaped and coloured synthetic product. There is much room for development in the finishing processes of the manufacture, but this should follow the recent report of the British Sulphate of Ammonia Federation, and in the fertiliser industry as a whole, we can look forward to a year of rapid development which will be all the more necessary because of the setback that we have received during the past few months.

Heavy Chemicals

The heavy chemical industry has continued to maintain a very high level during the year; but it is no longer true that long-established British industries can live on their old reputations alone. International competition has of late years become increasingly acute in the heavy chemical industries, and established practice more than ever susceptible to sudden and revolutionary revision, which by the nature of things is invariably compulsory. We now have, however, a powerful weapon in the form of the new combine which places us at once in fair competition with foreign countries, and at the same time consolidates our future position in a way that could never have been obtained by individual effort.

The stabilising effect of the combine will likewise be felt in the dyestuffs industry, while a more immediate factor which will favourably affect this branch of chemical industry is the promising sign of recovery in the cotton and wool industries. The recent successes in the field of artificial silk dyes will also make themselves felt in the coming year.

In the manufacture of artificial silk, the gradually increasing output of existing factories and the estimated output of factories now under erection will go a considerable way towards providing sufficient yarn for home consumption both in the manufacture of pure and mixed fabrics, and under more stable conditions than were obtained during 1926 there should be a reversal of the ratio of British to foreign yarn used in England during recent months.

Fine Chemicals

The fine chemical industry can look forward to further successes, for according to recent reports from competent foreign authorities, the British products are quite competitive with foreign makes in quality, and given normal external conditions, manufacturers should be able to attack the prices question more successfully than has been possible in the past.

In those modern developments of chemical industry which promise to revolutionise power problems—liquefaction of coal, synthetic alcohol production, and so on—it is gratifying to learn that Great Britain is not materially in the background, and that the comparative silence on the part of British researchers is not to be taken as indicative of the stages at which progress stands at present.

Developments in the Nitrogen Industry

By E. B. Maxted, D.Sc., Ph.D.

This year has seen a continuance of the trend towards a steadily increasing production of commercial nitrogen compounds by fixation, which has been traced during successive years in previous annual reviews. Various figures for the current annual tonnage of fixed nitrogen have been published; and, at the present time, probably about one half of the total world consumption of fixed nitrogen is covered by synthetic compounds, the most important of which continues to be ammonia. Synthetic ammonia plants are now in operation in almost every European country, in the United States, and elsewhere; and plans have also been made for the erection of installations in certain of the Colonies, for instance in Australia. This springing up and successful development on the largest scale of a difficult and revolutionary process is a striking sign of the new times in which chemical industry now lives. Physical chemistry and novel methods of attack, such as the use of extremely high pressures, are paving the way not only for the manufacture of ammonia, but also for the production of other compounds, in the front rank of which stands synthetic methyl alcohol.

The remainder of the consumption of nitrogen compounds is probably divided more or less evenly between by-product ammonia and Chile nitrate. The Chilean nitrate industry has, on the whole, been less active than in former years. The question is, to a large extent, an economic one; and the balance which must always exist between synthetic nitrogen compounds, by-product ammonia, and natural nitrates, is a matter of adjustment of price, accompanied possibly by a revision of the Chilean export duty.

Of the papers and patent specifications published during the year, the following may be noted specially :

Synthetic Ammonia

B. F. Dodge (1) has contributed an interesting paper on the relative economic merits of hydrogen prepared by the low temperature treatment of coke-oven gas and by the water gas catalytic process. Numerical data are given for each method, with special reference to American conditions. In view of the abnormal and uncertain cost of fuel, many of our older ideas on the relative cost of electrolytic hydrogen, especially from hydro-electric sources, may have to be reconsidered; indeed, in some works, electrolytic hydrogen is being used for ammonia. It may be pointed out that, if hydro-electric power can be obtained for ¼d. per kilowatt-hour, the cost of current is well below 3s. per 1,000 cub. ft. of hydrogen, even if no oxygen can be sold.

In previous reviews, many methods of purifying the reaction gas, before its passage over the catalyst, have been noticed. Two additional proposals have now been published. F. Uhde (2) suggests passing the gases through a solution of an alkali or alkaline earth metal in a molten alkali amide at 200–300° C.,

(1) *Chem. and Met. Eng.*, 1926, 33, 416.
(2) Brit. Pat. 247,226; The Chemical Age, Vol. 14, p. 386.

while, according to a method proposed by Lazote Inc. (3), the gas is freed from carbon monoxide by treatment under pressure with a catalyst, such as zinc carbonate, or a mixture of zinc and chromium oxides, capable of forming methyl alcohol under the conditions employed. As was to be expected, relatively few new catalysts for the synthesis have been described. Uhde, in a further patent, claims the use of catalysts containing ferro- or ferricyanides of metals other than iron (4). Metals, such as iron, nickel, and cobalt, in conjunction with lithium amide or nitride and alumina, magnesia, or calcium oxide have also been suggested (5). Each of these catalysts is not very dissimilar in type to those already used; and no published information is available to indicate what improvement in efficiency is obtained by employing the variation claimed.

From an engineering standpoint, several papers dealing with work at high temperatures and pressures have special reference to the synthesis of ammonia. J. G. Thompson (6) has discussed the types of steel which are sufficiently resistant to the weakening action of hydrogen to be suitable for use in those parts of the plant which are exposed to a relatively high temperature. A typical steel of this nature is one containing about 2 per cent. of chromium and about 0·3 of carbon; and it is desirable that the temperature of the pressure-resisting wall should be kept below 300°. This corresponds with existing practice. Two papers dealing with general high pressure construction, by F. A. Ernst (7) and by the author (8), describe various details of plant suitable for use in the synthesis of ammonia and similar reactions. High pressure equipment has to a large degree become simplified and standardised; and the construction of such plant is rapidly becoming a well-known, if special, branch of general engineering. While sliding or rotating joints which do not leak appreciably may be made satisfactorily, it is interesting to note the proposal of the Badische Anilin- und Soda-Fabrik (9) to enclose the driving motor of the circulating pump, used in the synthesis of ammonia, within the region of high pressure, since in this way the only sliding joint in the plant, save on the compressor (in which the lowest stage is usually not greatly removed from atmospheric pressure), may be avoided.

Variations in furnace design continue to be described. Thus, G. Cicali (10) has protected a special type in which the gas may be by-passed to the required degree through a heating element. Synthetic Ammonia and Nitrates, Ltd., Humphrey and Slade (11), describe a furnace in which the temperature may be equalised by reversing the direction of flow of the gas. Two other patent specifications dealing with pressure furnaces (12) and with heat exchangers (13) may also be noted. The first of these relates to a special form of the type of furnace enclosing the heat exchanger. The second specification describes a heat exchanger consisting of a system of annuli and small-bore U-tubes.

Reference may be made to a patent specification of H. W. Blackburn and W. Thomas (14), in which the production of ammonia by passing nitrogen together with a large excess of steam over iron at 450–550° C. is described, the working pressure being about 30 lb. only. In the ordinary synthesis of ammonia, even a trace of steam acts as an inhibitant; and the results claimed are of sufficient interest to warrant careful confirmation, since they would not be expected on general principles.

Other Methods of Nitrogen Fixation

The principal methods which fall under this heading are those leading to sodium or barium cyanide, calcium cyanamide, or to nitric acid by the arc process. An interesting study of the kinetics of the formation of nitric oxide in high tension arcs has been published by H. V. Tartar and M. F. Perkins (15). While the concentration of nitric oxide in the reaction gas decreased roughly linearly with increase in rate of passage, the bulk yield per hour passed through a maximum and afterwards decreased. Water vapour was found to inhibit the formation of fixed nitrogen, two to three per cent. of steam being sufficient to depress the yield to about three-quarters of its original value. Working at a decreased pressure exerted little or no effect on the yield.

The production of oxides of nitrogen in flames and the use of direct contact with water as a means of rapid cooling, is of interest technically, in spite of the lower equilibrium figure compared with arc temperatures, since practically the whole of the heat of combustion is obtained in the water. From this standpoint, special reference may be made to a paper by O. Brunler, (16) who gives figures which seem to indicate that calcium nitrate might be made at an economic cost by means of a flame burning under lime water. A further investigation of the process, not necessarily with lime water, would be interesting. It is well known that a mixture of nitrogen and hydrogen, neither of which need necessarily be pure, yields, on being burnt with oxygen under water, either ammonia or nitric acid, according to whether the proportion of oxygen renders the flame reducing or oxidising in nature.

Each year the apparently attractive formation of barium cyanide from elementary nitrogen receives attention, without however a solution being found for the fundamental technical difficulty which is inherent in all processes in which alkali or alkaline earth cyanides are produced at high temperatures, namely the corrosion of the reaction vessel. During the past year, a further contribution to our knowledge of this reaction has been made by A. Schweitzer (17). The paper contains much general information, particularly on the formation of barium cyanamide side by side with cyanide. P. Askenasy and J. Bring (18) have examined the influence of various secondary bodies on the relative proportion of cyanide to cyanamide in the above reaction. When a mixture of barium carbonate and carbon, containing about ten per cent. of barium fluoride, is treated with nitrogen, the reaction product contains about nine parts of barium cyanide to one part of barium cyanamide. If, however, five per cent. of iron is added, in place of the barium fluoride, the proportion of cyanamide rises to about seventy per cent. of the total nitrogen compounds, namely, to three times its former value. The use of calcium fluoride for lowering the reaction temperature in the formation of calcium cyanamide from the carbide has long been known; and these data relating to the displacement of relative cyanide content in the barium reaction are of great interest.

Manufacture of Nitrides

The manufacture of nitrides does not seem to have received so much attention as in former years; indeed, although some measure of success has been obtained with aluminium nitride under special local conditions, there appears to be no nitride which can easily be made from cheap, naturally occurring raw materials. The production of nitride-forming metals by electrolysis, and their subsequent treatment for conversion into nitride, has been dealt with by H. Janistyn (19). Fusible alloys, such as Wood's metal, are used as the cathode.

Finally, note may be made on an article on nitrogen fixation in general by Waeser, (20) in which a number of points connected with cyanide formation and other nitrogen fixation processes are discussed in an interesting manner. In reviewing the various methods of nitrogen fixation year by year, it is difficult not to be struck by the way in which high pressure processes are displacing those carried out at high temperatures. It may be that exceedingly cheap water power will enable calcium cyanamide to be produced also in the future, in economic competition with synthetic ammonia; but, even in the case of such cheap hydro-electric power, this may be used for the production of electrolytic hydrogen. The economic survival of processes is an uncertain field of chemical industry, and is one in which it is not safe to predict, even in the light of the current trend.

(3) Brit. Pat., 258,887; THE CHEMICAL AGE, Vol. 15, p. 528.
(4) Brit. Pat. 253,540; THE CHEMICAL AGE, Vol. 15, p. 209.
(5) Brit. Pat. 253,122; THE CHEMICAL AGE, Vol. 15, p. 209.
(6) Trans. Amer. Electrochem. Soc., 1926, 50, 1.
(7) *J. Ind. and Chem.*, 1926, 18, 664.
(8) *Chem. and Ind.*, 1926, p. 366.
(9) Brit. Pat. 245,533.
(10) Brit. Pat., 258,340; THE CHEMICAL AGE, Vol. 15, p. 402.
(11) Prit. Pat. 255,963/4; THE CHEMICAL AGE, Vol. 15, p. 232.
(12) Brit. Pat. 255,232; THE CHEMICAL AGE, Vol. 15, p. 184.
(13) Brit. Pat. 248,999; THE CHEMICAL AGE, Vol. 14, p. 385.
(14) Brit. Pat. 257,689; THE CHEMICAL AGE, Vol. 15, p. 376.
(15) *J. of Phys. Chem.*, 1926, 30, 595.
(16) THE CHEMICAL AGE, Vol. 14, p. 29.
(17) *Zeitschr. f. Elektrochem.*, 1926, 32, 98.
(18) *Zeitschr. f. Electrochem.*, 1926, 32, 216.
(19) Austrian Pat. 103,216, ex. *Brit. Chem. Abs.* (B), 1926, 744.
(20) Reprinted in part in THE CHEMICAL AGE, Vol. 15, p. 394.

Ammonium Salts

One of the problems of the synthetic ammonia industry is the nature of the ammonium salt which should be manufactured. If ammonium sulphate is made, there exists the need for large quantities of an extraneous acid for fixing the ammonia. Ammonium nitrate, the nitric acid portion of which can readily be made from ammonia by oxidation, possesses the advantage that both its acid and basic parts contain fixed nitrogen. It is, however, deliquescent and explosive; and the great explosion in the Badische works in 1921 indicates that not only ammonium nitrate, but also the double salts of sulphuric and nitric acids are not desirable as the ordinary form of fixed nitrogen. Ammonium chloride possesses no appreciable advantage over the sulphate; and, if the use of an extraneous acid is to be avoided, probably the most suitable salt is the carbonate, since, provided that the hydrogen for the synthesis is made catalytically from water gas and steam, large quantities of carbon dioxide are available from the process itself. Ammonium carbonate or carbamate is, however, unstable; and two principal methods of attack are available in order to avoid this fault, namely, firstly the stabilisation of the salt as such, and, secondly, its conversion into a compound such as urea.

According to a patent of the Badische Anilin- und Soda-Fabrik (21), the instability of commercial ammonium bicarbonate, which renders it difficult to preserve in storage—owing to loss of ammonia—is due to small quantities of ammonium carbonate and carbamate; and this instability may be to a large degree avoided if a pure salt is prepared by crystallisation from a hot solvent, carbon dioxide being passed in during the process. The same effect is not obtained if carbon dioxide is passed through the solution during crystallisation by cooling. Crystals of ammonium bicarbonate, obtained from hot solutions, lose practically no ammonia during a period in which ordinary ammonium bicarbonate would lose at least fifty per cent. It is stated that the stability may also be increased by adding benzene. Somewhat similar observations have been made by Synthetic Ammonia and Nitrates, Ltd. (22) with regard to ammonium carbamate. Commercial ammonium carbamate is unstable below 30° C. in the presence of water. In order to prepare a stable salt, ammonia and carbon dioxide, in the proportion of two to one by volume, are passed into water at higher temperatures up to 50° C. Solid ammonium carbamate is continuously precipitated and is separated by filtration.

In spite of the above considerations, ammonium sulphate continues to be by far the most important ammonium salt, both of synthetic and of by-product ammonia. The production of large crystals of ammonium sulphate in gasworks practice has been discussed by H. J. Hailstone(23). The correct physical conditions which must be maintained for a period sufficient for the growth of the crystals are dealt with; and the paper contains interesting notes on suitable plant. Attention may also be drawn to a number of practical papers dealing with the manufacture of sulphate of ammonia in gasworks. Thus, G. J. Greenfield (24) has dealt in a clear manner with the caking of ammonium sulphate and its avoidance. The importance of large crystals of even size is emphasised, and the use of ammonium carbonate as a neutralising agent in the manufacture of neutral sulphate is discussed. A further paper on neutral sulphate has been contributed by C. Bateman, (25) while the analytical determination of acidity in gasworks sulphate has been discussed by T. B. Smith (26) and H. M. Lowe(27). The manufacture of neutral sulphate has also been dealt with in Brit. Pat. No. 259,669, in which an apparatus is proposed which enables the salt to be treated with an ammonia current which moves in countercurrent to the ammonium sulphate in the conveyor. Before leaving the subject of ammonium sulphate, mention may be made of the various ammonium salts containing phosphorus which are being placed on the market by German producers. The I.G. Farbenindustrie, for instance, (28) suggests the employment for agricultural and other purposes of a mixed salt prepared from ammonium nitrate and diammonium phosphate.

The utilisation of nitre cake (sodium bisulphate) has again received attention. H. Molitor (29) has defined the conditions under which sodium bisulphate solutions, which have been saturated with ammonia, may be caused to deposit crystals of normal sodium sulphate, leaving ammonium sulphate in solution. Complete separation cannot be obtained; but the presence of a little sodium sulphate in ammonium sulphate is stated not to be prejudicial to its use as an agricultural fertiliser.

A number of papers dealing with the absorption of ammonia in scrubbers have been cited in former reports. This year, a number of data have been contributed by T. K. Sherwood and A. J. Kilgore, (30) for details of which the original should be consulted.

Nitric Acid and Nitrates

The amount of experimental work which has been done on the oxidation of ammonia to nitric acid during the past year does not appear to be very great. A systematic investigation of the composition of the reaction gases formed by passing ammonia and air over a platinum gauze catalyst at various temperatures has, however, been carried out by L. Andrussov (31). Secondary reactions, such as the interaction of nitric oxide with ammonia, do not become important until about 500° C. A high yield of nitric oxide could be obtained even with the platinum gauze at 1000° C., provided that the velocity of passage was relatively high. Two patents by I. W. Cederberg (32) for the use of oxygen in the oxidation of ammonia may be mentioned. Explosion is prevented by using a flat and narrow reaction chamber.

Several patents of interest relating to various nitrates have appeared during the period under review. In order to avoid the inconveniently slow solidification of calcium nitrate which takes place normally on cooling a saturated solution, a small percentage of ammonium nitrate is added (33). For instance, a hot concentrated solution of calcium nitrate, which solidified, slowly at 30° C., was found to solidify at 70° C. if five per cent. of ammonium nitrate were added. The Badische Co. has also proposed the preparation of solid calcium nitrate by bringing rollers heated to 250° C. in contact with a highly concentrated solution of calcium nitrate, the solid salt being removed by scrapers.

In preparing barium nitrate by dissolving barium carbonate in nitric acid, the output of a plant is restricted by the small solubility of barium nitrate. In order to avoid this, nitric acid may be added to a strong solution of barium chloride (34), when barium nitrate is precipitated and hydrochloric acid remains in solution. This hydrochloric acid is used for the preparation of a further quantity of barium chloride from the carbonate.

Cyanogen Compounds

In addition to its older uses, hydrocyanic acid has become of importance for the fumigation of trees and for the destruction of vermin. In order to stabilise liquid hydrocyanic acid and to prevent polymerisation, it may be slightly acidified with sulphuric acid, or a metal, such as copper, which will form a complex with ammonia, may be added (35). Compounds such as cyanogen chloride have also been proposed as stabilisers.

A process for the manufacture of calcium cyanide may be noted. F. G. Metzger (36) adds calcium carbide to hydrocyanic acid containing about 1 per cent. of water. The method is of particular interest since calcium cyanide has previously only been known in dilute solution. It is rapidly decomposed by atmospheric moisture, and may thus be used as a safe form of hydrocyanic acid for fumigation or other purposes.

The production of ammonium cyanide, formamide and hydrocyanic acid by passing ammonia and an alkyl formate over a dehydration catalyst such as alumina is discussed in a patent of the Badische Anilin- und Soda Fabrik(37). The nature

(21) Brit. Pat. 244,645; THE CHEMICAL AGE, Vol. 14, p. 112.
(22) Brit. Pat. 258,048, THE CHEMICAL AGE, Vol. 15, p. 376.
(23) *Gas J.*, 1926, 174, 646.
(24) *Gas World*, 1926, 84, 26 (Coking Section).
(25) *Gas J.*, 1926, 173, 748.
(26) *Gas World*, 1926, 84, 26 (Coking Section).
(27) *Gas World*, 1926, 84, 30 (Coking Section).
(28) Brit. Pat. 256,972; THE CHEMICAL AGE, Vol. 15, p. 403.
(29) *Chem. Zeitung*, 1926, 50, 485.
(30) *J. Ind. and Eng. Chem.*, 1926, 18, 744.
(31) *Zeitschr. f. angew. Chem.*, 1926, 39, 321.
(32) Brit. Pat. 246,889; THE CHEMICAL AGE, Vol 14, p. 253.
Brit. Pat. 244,134; THE CHEMICAL AGE, Vol. 14, p. 185.
(33) Brit. Pat. 249,370; THE CHEMICAL AGE, Vol. 14, p. 419.
(34) Brit. Pat. 248,593; THE CHEMICAL AGE, Vol. 14, p. 361.
(35) U.S. Pat. 1,591,899.
(36) *J. Ind. and Eng. Chem.*, 1926, 18, 161; U.S. Pat. 1,573,732.
(37) Brit. Pat. 254,787; THE CHEMICAL AGE, Vol. 15, p. 163.

of the product depends on the time of contract and on the temperature, for instance methyl formate and ammonia, when passed over alumina at 260° C., gave a 95 per cent. yield of hydrocyanic acid. Several proposals for the transformation of calcium cyanamide into cyanide have appeared. Thus, Franck and Heimann (38) treat calcium cyanamide with water-gas at a low red heat. Hydrocyanic acid is evolved and is absorbed by alkalis in the usual way. H. G. A. Ramsay (39) heats a mixture of calcium cyanamide with an alkaline chloride or carbonate. After fusion, the mass is treated with caustic soda in sufficient quantity to convert the whole of the calcium into hydroxide. Finally, a further investigation of the formation of sodium cyanide by the Bucher process may be noted (40). An increase in the rate of supply of nitrogen, within limits, was found to increase the rate of conversion into cyanide, as would be expected from considerations based on mass action. It is interesting to note that under certain conditions metallic sodium was obtained in small quantities. This agrees with the theory of the process outlined in former Annual Reviews.

It has not been possible, in preparing the above review, to include every paper and patent dealing with the nitrogen industry which has appeared during the year. Nevertheless, it is representative of what has been done; and it will, it is hoped, form a guide to the current trend of work in this branch.

(38) Ger. Pat. 417,018, ex *Brit. Chem. Abs.* (B), 1926, p. 125.
(39) Swed. Pat. 580,030, ex *Brit. Chem. Abs.* (B), 1926, p. 273.
(40) *J. Ind. and Eng. Chem.*, 1926, 18, 243.

Synthetic Nitrogen and Food Supplies

By Dr. F. A. Freeth, F.R.S.

THE great industrial expansion and increase of population in the last century in this country soon reached a point where food requirements were greater than home supplies. From that day to this we have imported large and increasing quantities of essential foodstuffs. Such supplies were drawn from the open fertile spaces of the world. The virgin plains of Canada and the United States, to mention one tract only, yielded splendid harvests year after year without the addition of artificial fertilisers. Agriculture in such districts was living on the accumulated resources of centuries. The situation in this country, however, has been quite different for many years. A plot of ground will go on yielding a wheat crop of a sort without addition of manure of any kind. There is one at the Rothamstead Agricultural Station, but the yield per acre soon falls below an economic limit.

Nitrogen in a chemically combined form is one of the essentials of plant life. Nitrogen constitutes about four-fifths of the air we breathe, but in the air is in its native elemental condition, and as such is practically useless for agriculture. There are in the soil certain bacteria which are capable of assimilating and combining nitrogen direct, but the quantity which they can thus "fix" falls greatly short of that required under modern agricultural conditions. Nitrogen is an inert material and does not combine readily under easily obtainable conditions.

It is usually added to the soil in the form of a combination with oxygen or with hydrogen. Up to fairly recent years the principal sources of supply of fixed nitrogen have been the Chile nitrate fields, the product of which, sodium nitrate, may be classified as an oxygen compound of nitrogen, whilst the other, the familiar sulphate of ammonia, which can be regarded as a hydrogen compound of nitrogen, has been derived as a by-product from the distillation of coal.

Since water is composed of hydrogen and oxygen, and the air of nitrogen and oxygen, the raw materials for the fixation of nitrogen are, at least in part, common to the whole of mankind. While the stored-up agricultural resources of the world on which we have been living are far from being exhausted, their call for outside assistance in the form of fixed nitrogen is definitely increasing. To-day it is considerable; in the near future it will be enormous. It is, for example, open to grave doubt if the Chile nitrate fields and the gasworks industry could between them supply the present nitrogen requirements of the world.

The rise of the synthetic nitrogen industry is one of the greatest chemical changes of modern times, and is one of the utmost importance for the future of our food supplies.

Nitrogen, as already explained, is required combined either with hydrogen or oxygen, and in either case the resultant material requires another substance to solidify it and hold it down. The product of the combination of nitrogen and oxygen is nitric acid, which must be neutralised by an alkali, usually lime, before it can be used in agriculture, whilst the combination of nitrogen with hydrogen is an alkaline gas (ammonia), which must be neutralised with an acid, usually sulphuric acid. From the point of view of Great Britain, it is impracticable to combine nitrogen with oxygen. In countries where the abundance of waterfalls furnishes very cheap electric power, it is possible to burn the air itself by means of an electric flame forming nitric acid. This process is impracticable in Great Britain, and we have therefore to fall back on the combination of nitrogen and hydrogen, or in plainer words, air and water. Here, again, by reason of our lack of water power, an attractive possibility is ruled out. It is well known that by passing an electric current through water it is decomposed into hydrogen and oxygen gases, which appear separately at the places where the electricity enters and leaves the water. This process is dependent on cheaper power than we can produce in this country. As far as we are concerned, the problem is solved by our great national asset of coal.

The process recently developed on a great scale at Billingham-on-Tees, at the works of Synthetic Ammonia and Nitrates, Ltd., a constituent of Imperial Chemical Industries, Ltd., is already tending to and will eventually render us independent of foreign supplies. The raw materials are water, air, and coke. It may be described simply by saying that coke is burnt (burning being combination with oxygen) in a mixture of air and steam in such a way that the coke robs both the air and the steam of their oxygen and leaves a mixture of nitrogen, hydrogen, and the combustion product of coke, namely, carbon dioxide. The carbon dioxide is removed with little difficulty, leaving a mixture of nitrogen and hydrogen which are the constituents of ammonia. These are then brought to a very high pressure and passed over a catalyst. They combine and form ammonia gas, which has to be reduced to a form which will render it usable and transportable. This is done by means of the carbon dioxide, which, combining with ammonia to form ammonium carbonate, acts by double decomposition on calcium sulphate, a material which this country possesses in very great quantities. Ammonium carbonate and calcium sulphate yield ammonium sulphate and calcium carbonate. The sulphate of ammonia produced is, of course, a first-class agricultural manure. It can only be profitably made in enormous units with very high output, and it may be predicted that the future nitrogen supplies of the world will be produced at quite a limited number of places, one, and not the least important of which will be in this country.

There is an intimate connection between the fixation of nitrogen and the supply of explosives in war time. This country in the war derived the whole of its fixed nitrogen supplies from Chile. Germany did not go to war until she was assured that her nitrogen fixation industry was sufficiently developed to supply her requirements, as she could not hope to keep open the long sea route to Chile. It is now common knowledge that both the allied and enemy general staffs underestimated their requirements in the early stages of the war, and that Germany was compelled to and did expand her synthetic production enormously.

Explosives for war purposes may be roughly classified into propellants, such as cordite, and explosives proper, such as T.N.T. and ammonium nitrate. All these materials, which modern warfare consumes in thousands of tons, require nitric acid for their manufacture. The great newly-established British nitrogen fixation industry produces ammonia. Ammonia, when burnt with a limited supply of air, yields nitric acid. It will thus be seen that both for peace and for war the new development is of the greatest national importance.

A Review of Heavy Chemical Industry in 1926

By P. Parrish, A.I.C., M.I.Chem.E.

THE age of big businesses was signalised during 1926. Imperial Chemical Industries, Ltd., is an outstanding example. It is not difficult to appreciate the advantages of such an amalgamation. That this country now possesses a trust largely concerned with the production of heavy chemicals, which is capable of meeting strength with strength, and which will not readily be vulnerable to competition, from whatever quarter it may come, is not doubted. In last year's review the inter-relation of the various heavy chemical activities was remarked upon. Time only tends to emphasise its importance.

Sulphuric Acid

The sulphuric acid industry is passing through a period of extreme perplexity. In 1915 the production (1) of sulphuric acid in this country was 1,083,000 tons, expressed as 100 per cent., and the capacity for production was 1,200,000 tons, expressed as 100 per cent. During 1926 it is doubtful whether sulphuric acid plants have operated to the extent of 40 per cent. of their capacity. But what is more disconcerting is that, with a restoration of trade to normal, it is hardly likely that the 1915 production figure will be approached. The reason for this is not far to seek.

Nothing is more certain than that the future will witness the development of processes involving the use of high pressures and high temperatures. Not only is the synthetic ammonia industry an example, but the Bergius process (2) for the hydrogenation of coal in the production of motor fuels and others for the production of organic acids are well known.

It is suggested that Synthetic Ammonia and Nitrates, Ltd., at Billingham, will eventually be producing 300,000 tons (3) of ammonium sulphate per annum. This represents the equivalent of 276,000 tons of sulphuric acid of 80 per cent. Unfortunately for the sulphuric acid industry, calcium sulphate (anhydrite) is being largely used, because it constitutes a cheaper radicle than sulphuric acid.

Similarly, large quantities of nitric acid are being produced from ammonia by the Ostwald process. Here again, the use of sulphuric acid is being displaced. But this is not all. Attention is being focused on the production of phosphoric acid by the volatilisation method, as a means by which a phosphatic-nitrogenous fertiliser can be produced. Such a chemical fertiliser will compete with compound manures in which calcium superphosphate is invariably a component. Neither anhydrite nor sulphuric acid will be required in the production of the chemical fertiliser named in respect of either element—phosphorus or nitrogen. Clearly, therefore, the demand for sulphuric acid is likely to suffer still further.

If, in addition to the foregoing, the by-product ammonia industry is led to effect economies in the cost of manufacture by the use of anhydrite (a cheaper radicle) (4), the sequel is far from encouraging.

As regards technique, space only allows of brief reference. Dr. T. L. Bailey (5) continued experiments to establish the conditions necessary for the successful use of water as a final scrubbing medium for the exit gases from the chamber process. Among the conclusions reached are the following: (i.) Nitroso-sulphuric acid cannot produce nitrous acid alone on decomposition with water, but a mixture of oxides of nitrogen. (ii.) Excess of sulphurous acid in presence of water causes evolution of nitrous oxide from nitrous acid, with the production of hydroxyamido-sulphuric acid, $HONH(SO_3H)$. (iii.) Nitrous oxide is evolved when excess of nitrous acid reacts with sulphurous acid in the presence of water. (iv.) Nitric oxide is slowly reduced to nitrous oxide by sulphurous acid, in the presence of sulphuric acid of greater dilution than $d1{\cdot}07$. Nitrous oxide is probably produced in this way in the initial chambers in the neighbourhood of water sprays or steam jets.

(1) CHEMICAL AGE, Vol. XV, p. 104.
(2) *Ibid.* Vol. XIV, p. 222.
(3) *Ibid.* Vol. XV, p. 426.
(4) *Ibid.* Vol. XV, p. 537.
(5) *Ibid.* Vol. XIV, pp. 562 and 565.

Important Developments

Of the developments of importance relating to manufacture, three only need be cited.

(I.) An intensive system of manufacture by the chamber process has been covered by H. Petersen (6). Intimate mixture of gases and liquid is ensured by the use of graded filling material.

(II.) Mills-Packard (7) have protected a chamber system having chambers of circular cross section, with the gas inlet placed comparatively near the bottom, and tangential to the wall. The outlet is still nearer the bottom, but on the opposite side of the chamber. Convection currents are presumably relied upon to give the necessary circulation to the gases within the chamber.

(III.) The adoption of Gaillard turbo dispensers (8) to the extent of no less than 150 is evidence of the growing appreciation of the importance of the liquid phase as the essential factor in sulphuric acid production. This aspect has been developed in a recent article, which deals, *inter alia*, with the application of the dispersers in question to all types of chamber, irrespective of shape or dimensions. It is certain that this system will contribute to an appreciable reduction in the cost of manufacture of this acid.

It is known that in some localities in the North B.O.V. has been displaced by oleum. The significance of this should not be lost sight of.

By-Product Ammonia

Probably the outstanding event was the International Conference on Nitrogen Propaganda, held at Biarritz. No other conclusion can be drawn from it than that nitrogenous fertilisers must be cheap for an indefinite period. Prices (9) for sulphate declined by about 10 per cent. in 1925-26 as compared with the previous year. As the costs of manufacture of synthetic ammonia are likely to be still further reduced, the prospects before the producer of by-product ammonia becomes less hopeful.

Although further reference has been made during the year to the Jaques, Morgan and West process (10)—one relating to the production of sulphate of ammonia without the use of sulphuric acid—it is known that the oxidation of sulphite to sulphate presents difficulties. Moreover, assuming a satisfactory oxidation process can be established, doubt exists as to the suitability of this salt as regards crystal structure and other characteristics. Despite the fact that the by-product ammonia industry must continue to be reckoned with (11), since coal gas and metallurgical coke must inevitably be produced, its salvation lies (*a*) in mass production, (*b*) in an alteration or modification of the method of recovery of by-product ammonia, and (*c*) in the utilisation of obvious gasworks resources. To depend on one process would be fatal. Geographical position and local needs will largely dictate the *modus operandi*.

The Effluent Problem

The effluent problem still continues to engage attention. (12) It is a feature of importance in connection with any modified process. One or two methods (13) and (14) have been protected during the year. Whatever one may think of the relative merits of vertical retorts as contrasted with horizontal ones, it is certain that the gas liquor resulting from the former is appreciably more toxic than that emanating from the latter. Again, when considering the economics of steaming in horizontal or vertical retorts, the pecuniary disadvantage of the increased yield of virgin gas liquor of low ammonia concentration should certainly be determined, and should appear on the debit side of any monetary statement.

(6) CHEMICAL AGE, Vol. XIV, p. 460, E.P. 249,914.
(7) E.P. 247,644.
(8) CHEMICAL AGE, Vol XV, p. 560.
(9) *Ibid.* Vol. XV, p. 537.
(10) *Ibid.* Vol. XIV, pp. 154 and 201.
(11) *Ibid.* Vol. XIV, p. 23.
(12) *Ibid.* Vol. XV, p. 563.
(13) *Ibid.* Vol. XIV, p. 211, L. W. Heffner.
(14) *Ibid.* Vol. XV, p. 511, H. W. Robinson and D. W. Parkes.

New Synthetic Fertilisers

The selling and propaganda functions formerly undertaken direct by the British Sulphate of Ammonia Federation have been transferred to Nitram, Ltd. (15) This company will not only be responsible for the sale of sulphate of ammonia, but for all products required for agricultural purposes that are or will be made at Billingham. What precisely these products are likely to be one can only conjecture. Judging by protected processes, affecting not one synthetic ammonia works, but many, it would appear that calcium nitrate (16), stable bicarbonate of ammonia (17), calcium nitrate and urea (18), ammonium nitrate, etc. (19), calcium nitrate and phosphoric acid (20), ammonium phosphate (21), di-ammonium phosphate (22), and solid compounds of ammonium CO_2 (23) (presumably either urea, stable bicarbonate of ammonia (23), or bicarbonate of ammonia and carbamate) are potential products.

Apart from the foregoing, one must not be oblivious to the two double salts (24) in which reliance is being placed in Germany, namely, potash and ammonium nitrate, BASF, and Leunasaltpeter, BASF, which is an ammonium-sulphate-nitrate. Neither can one ignore the more recent product Nitrophoska (25), which is being prepared in two qualities. No. 1, for heavy soils, contains 17 per cent. N_2, 11·7 per cent. w.s. P_2O_5 and at least 21 per cent. K_2O. No. 2, which is available for lighter soils, contains 14·7 per cent. N_2, 10·2 per cent. P_2O_5 and 26·6 per cent. K_2O. Nitrophoska is being made at Wolfen, from potassium chloride, via the nitrate.

What is the significance of these activities of the synthetic ammonia works? Briefly this. Synthetic ammonia works and the superphosphate industry will be keen competitors before long. Technically, the question at issue, apart from economy of manufacture, will be whether chemical fertilisers containing potash, phosphate, and nitrogen, or potash and nitrogen, or phosphate and nitrogen, are better than compound fertilisers.

Exhaustive treatment is impossible here, but four terse references must be made. (1) Apparatus for economising steam in the distillation of gas liquor has been protected. (26) (2) L. Fokin (27) describes a cyclic process, which may be advantageous as a partial solution of the effluent-disposal problem. Subject to certain treatment, effluent liquor is used again for further ammonia absorption. (3) H. J. Hailstone (28) deals with the factors contributing to the crystal formation of ammonium sulphate. Large crystals are the result of unvarying low acidity, thorough circulation, and sufficient time contact for crystal growth. (4) Ammonia recovery by gypsum (29), direct ammonia recovery (30), and the economics of the foregoing (31) have been commented upon during the year.

Superphosphate Industry

It is significant to note that following the Biarritz Conference of the European nitrogen works, an international conference of the superphosphate industry (32) met at Paris. This was succeeded by another in London. One can infer what the sequel will be. International co-operation in the matter of scientific investigation as to the importance of phosphoric acid in general and superphosphate in particular, the joint use of the results of research work, a new industrial branch in which all nations participate, and improved developments of organisation will undoubtedly result.

What must be watched is the development of the Liljenroth method (33) of producing phosphoric acid, diammonphos, and related products. This consists in producing, in the first place, ordinary yellow phosphorus in an electric furnace. Phosphorus is then blown in vapour form, together with steam, over a catalyst at 1,000° C., whereby phosphoric acid is yielded, and hydrogen is generated. The hydrogen can appropriately be used for the preparation of synthetic ammonia, and the P_2O_5 can be absorbed in a peculiarly attractive way, so as to be available for fertilising purposes, without the employment of sulphuric acid.

This fascinating method, although hitherto not unknown to some technicians, is the subject of two patents (34). P_2O_5 is absorbed from gases containing it by ammomium phosphate solution. A hot saturated solution is obtained, and solid ammonium phosphate separates on cooling. The mother liquor is repeatedly used for the absorption. The second patent has a two-fold merit. P_2O_5 and *ammonia* are added to a saturated solution of diammonium phosphate, while maintaining the ratio of 1 molecular proportion of acid to between 1·5 and 2 molecular proportions of ammonia. The above is controlled by titration, hydrogen-ion concentration measurements, or indicators of suitable transition points. The heat of reaction evaporates the required amount of water, and the solution is cooled and gaseous ammonia is added, until the solution contains 2 proportions of ammonia and 1 of acid. Pure diammonium phosphate separates out.

Is this process to be exploited solely by the synthetic ammonia works? Is there no analogous process which the superphosphate industry could commercialise if it chose? It is known that there is such a process, and that by-product ammonia could with advantage be utilised in this connection.

During the year reference has been made to other interesting processes (35) for the manufacture of phosphoric acid or its anhydride.

Alkali Industry

The alkali industry is in a strong position, and the formation of Imperial Chemical Industries, Ltd., augurs well for its future development. Even the process of the manufacture of soda ash and its by-products by the ammonia-soda method is still capable of improvement and development (36). Brunner, Mond and Co. (37) have sanctioned the expenditure of no less than £100,000 for the purpose of a new research laboratory at the Winnington works, in order to strengthen the existing research department.

Interesting information concerning the Backman process (38), for the production of bleaching powder, has been published. Prodorite (39) as a jointing material, etc., for hydrochloric acid and other purposes, has become more popular. The production of hydrochloric acid from ferrous chloride has been protected (40).

Many other interesting processes have been covered during the year—one for the production of barium peroxide (41), and another (42) for the production of barium sulphide, a step in the production of barium peroxide, and two relating respectively to chromates and chrome alum (43 and 44) should be carefully watched.

Synthetic Ammonia

Efforts appear to have been directed during the year to the production of cheaper hydrogen via (*a*) water gas, and (*b*) coke oven gas (45), to the removal of traces of CO (46) (presumably an inhibiting agent) from hydrogen, to economy of heat and the adoption of special interchange heaters. (47) A modified process (48) has been protected. It provides for the passage

(15) CHEMICAL AGE, Vol. XV, pp. 512, 516, and 558.
(16) *Ibid.* Vol. XIV, p. 82.
(17) *Ibid.* Vol. XIV, p. 112.
(18) *Ibid.* Vol. XIV, pp. 211 and 440, B.A.S.F., E.P. 246,377.
(19) *Ibid.* Vol. XIV, p. 386, see Toniolo, E.P.'s 247,227, 8 and 9.
(20) *Ibid.* Vol. XIV, pp. 386 and 482.
(21) *Ibid.* Vol. XV, p. 209, I.G. 255,766.
(22) *Ibid.* Vol. XV, p. 233, I.G. 256,137.
(23) *Ibid.* Vol. XV, p. 376, S.A. and N., Ltd., E.P. 258,048.
(24) *Ibid.* Vol. XIV, p. 430, Dr. Bueb's paper, *Gas World*, Vol. LXXXIV, p. 536.
(25) *Ibid.* Vol. XIV, p. 430.
(26) G. P. 423,849.
(27) *J. Chem. Ind. Russ.*, 1926, 2, 319.
(28) *Gas Journal*, 1926, 174, 646.
(29) CHEMICAL AGE, Vol. XV, p. 267.
(30) *Ibid.* Vol. XV, p. 290.
(31) *Ibid.* Vol. XV, p. 267.
(32) *Ibid.* Vol. XIV, p. 543.
(33) *Ibid.* Vol. XV, p. 219.
(34) CHEMICAL AGE, Vol. XV, p. 233, E.P. 255,766 and I.G., E.P. 256,137.
(35) *Ibid.* Vol. XIV, pp. 82 and 482, E.P., W. Kyber, 242,650 and E.P., I.G., 259,201.
(36) *Ibid.* Vol. XIV, p. 454.
(37) *Ibid.* Vol. XIV, p. 454.
(38) *Ibid.* Vol. XV, p. 244.
(39) *Ibid.* Vol. XV, p. 203.
(40) *Ibid.* Vol. XV, p. 477, E.P. 259,348.
(41) *Ibid.* Vol. XV, p. 33.
(42) *Ibid.* Vol. XV, p. 184.
(43) *Ibid.* Vol. XV, p. 477.
(44) *Ibid.* Vol. XV, p. 572, I.G., E.P., 260,855.
(45) *Ibid.* Vol. XV, p. 266.
(46) *Ibid.* Vol. XV, p. 500, Cicali, E.P., 259,643.
(47) *Ibid.* Vol. XV, p. 184, S.A. and N., Ltd., E.P.'s 255,232 and 255,963.
(48) E.P.'s 257,189 and 258,154.

of steam and pure nitrogen over a catalyst at a pressure as low as 2 atmospheres. Iron, nickel, nickel oxide, ferrous oxide, and charcoal are mentioned as catalysts, the effective temperatures being respectively 500°, 1,000°, 400°, 500°, and 800° C. It is not inconceivable that more will be heard of this process.

The results anticipated concerning new catalysts and the Mont Cenis process, if realised, have not apparently been acclaimed. Singularly little information can be culled concerning the last-named process.

A Prediction

The writer hazards the prediction that, given freedom from industrial troubles, the volume of trade in the heavy chemical industry will, if not in 1927, certainly in 1928, eclipse any previous record. A slow metamorphosis has been proceeding during the last few years; it has now culminated in new processes and new activities, and it only remains for employers and employees to co-operate judiciously to consummate the results of research and sound commercial policies, which have already been initiated.

Fine Chemical Progress in 1926

Confidence in the Future

A HEALTHY consolidation of the work of fine chemical manufacturers can be reported. If proof is wanted that the fine chemical industry has continued to make real sound progress during the past year, it is supplied by the replies given to inquiries addressed to the more important manufacturing firms engaged in this branch of chemical industry.

Fine chemical manufacture calls for a continuous and patient expenditure of scientific effort in perfecting processes to bring costs to the lowest level. For many years now this had been the chief concern of those engaged in the industry, and during the past year much work of this character has borne fruit. Naturally these are not aspects of the subject of which manufacturers are willing to supply details, but there was never greater confidence in the future than there is at the present time. The recent renewal of the Safeguarding of Industries Act for a period of ten years has done much to inspire greater effort. It is to be hoped that these will be for fine chemical manufacturers ten years of peace and security in contrast with the past five years of strife and doubt. The feeling of security for a period of time, necessary if industrialists are to invest large amounts of capital which cannot be hoped to bring an immediate return, will suffer material damage if inroads to any large extent are to be made upon the list of substances protected.

Many additions to the list of fine chemicals manufactured in this country have been made during the year 1926, so that the total list of fine chemicals now manufactured in this country comprises 2,900, as compared with 1,800 made in 1922; and it may be confidently stated that a census of production would show an even greater increase in the total value of our production.

Out of so large a number of compounds, it is an invidious task to single out any for particular mention, but since thyroxine has been brought prominently into notice of late, this product may be taken as an example of a noteworthy scientific achievement which has been accomplished throughout by British brains and British hands. Following the discovery by Dr. C. R. Harington of a method of extracting throxine from thyroid gland which very greatly increased the yield, the large-scale production of thyroxine by the utilisation of Dr. Harington's method of extraction was undertaken by a British firm of fine chemical manufacturers, with the result that this product is now available at a price which makes it possible for medical men to administer it at no greater cost than that of the dried gland itself. It is to be expected that medical men will now prescribe thyroxine itself in the place of preparations made from the gland, which indeed show such extraordinarily wide variations in activity that prescribing "thyroid gland" is really largely a matter of chance. Dr. Harington's researches on the subject of thyroxine have been crowned with the fine success of achieving the synthesis of throxine, and his work has been recognised in the award to him of the Harrison Memorial Prize.

Growing Repute of British Products

In referring to British gland products, the following report which appeared in the *Mercantile Guardian* recently will be of interest:—"When everybody is pessimistic about British exports it is rather refreshing to read what my Near East correspondent says about British fine chemicals. He tells me that a medical journal in Vienna complains that German fine chemicals and preparations have reached their twilight, and that their place is being steadily taken in all clinics and hospitals by British products. This is most pleasing. It appears that the principal preparation the journal had in mind was insulin, and that doctors are, throughout the Near East, insisting on having British, as being vastly superior to the German insulin, which, even offered below cost, has no market. My correspondent adds that this is not the only case where doctors in their prescriptions insist on the ingredients of a prescription being made of British material. A few more confessions of a like nature will do British trade no harm."

The foregoing report is independently confirmed by the recent observations and experience of a special emissary of British manufacturers and exporters of fine chemicals, who, on a tour throughout the Continent found that British insulin is freely recognised as the best, and in enlightened centres, such as the better parts of Germany, is used in preference to the cheaper Continental products. The other fine chemicals referred to in the above-quoted paragraph are no doubt those chemicals for scientific purposes, the manufacture of which has been developed by a leading British firm of chemical manufacturers, which chemists, microscopists, and bacteriologists testify are superior to pre-war German products.

The foregoing report affords striking testimony to the excellence of British insulin and other fine chemicals. We say "other fine chemicals" advisedly, since the manufacture of insulin, thyroxine, pituitary extract and other gland products, is essentially "fine chemical" manufacture. It is a source of satisfaction to know that in this branch of fine chemical industry, the importance of which is being rapidly recognised and is rapidly growing, this country has come to the forefront.

Among synthetics, British-made coumarin is now produced in this country in quantity in excess of any home requirements and allowing a considerable surplus to be exported. Heliotropin, synthetic menthol, nerol and cinnamyl alcohol are substances now made in this country in excellent quality and sold at competing prices.

In connection with the development of fine chemical manufacture, we may remark that if it should happen that 1927 should see the consummation of efforts extending now over several decades to have methanol (methyl alcohol) removed from the list of dutiable substances, this would be a great stimulus and aid to chemical industry—both to the heavy chemical industry in which it would be made, and to the fine chemical industry in which it would be used in multitudinous ways.

Isopropyl alcohol has been manufactured in this country in increasing amount by a synthetic process and the availability of this product at low prices has already opened up new uses for it and its derivatives.

Other solvents to which attention has been given of late by manufacturers in this country are those for use in the making of lacquers and dopes. Among these it is interesting to note that diacetone alcohol is produced at a comparatively low price; and, boiling as it does at 164° C., it should prove of considerable use in many branches of industry.

New Substances

Turning to another field of fine chemical manufacture, new substances have recently been introduced for improving the manufacture of india-rubber goods. These chemical compounds are sold under trade names, and their effects in

improving manufacturing conditions are remarkable. By judicious selection the elasticity and toughness of vulcanised rubber can be controlled within fine limits and its wearing properties remarkably improved. A new development is the use of anti-oxidants. These retard oxidation and thus confer upon cured rubber a greatly increased resistance to ageing or perishing.

Despite the adverse conditions prevailing in the year 1926, with industry harassed by industrial disputes and political unrest, resulting in decreased purchasing power of the public and a diminution of trade in both home and export markets, the fine chemical industry has continued to hold its own among the industries of the world and, indeed, to make remarkable progress. Scientific and industrial research has been maintained and important discoveries achieved. What manufacturers now need are returning confidence and better conditions. The promise of a brighter outlook and peaceful conditions should encourage manufacturers to utilise their scientific and financial resources for the development of their industry. Given quiet conditions, freedom from legislation, less burdensome taxation, and a policy on the part of the Government promising confidence and a period of rest and stability, the prospects of the fine chemical industry for the coming year are of the brightest.

The Dyestuffs Industry in 1926

By Ronald S. Horsfall, M.Sc.

1926! WHAT is there to be said in appreciation of it? That British industry has survived another shock in the form of a seven months' coal stoppage is, indeed, a proof of extraordinary vitality, but bare existence will not enable Great Britain to hold its own as an industrial nation, and no mercy is shown to convalescents in these extraordinarily difficult times. The last is particularly true of the dyestuff industry which, considered internally, is possessed of a large amount of redundant plant, and therefore is always in danger of undergoing the method of elimination described as the survival of the fittest. Fortunately the policy adopted by the chief dyestuff consuming industries was that of carrying on at all costs, and under these circumstances business has kept up well enough to enable one to regard 1926 as a period of marking time rather than as one of serious losses.

Research

On the research side it can be confidently stated that never was research more active in the organic chemical industry, both in this country and abroad. Chemicals hitherto spoken of in pounds promise to be quoted in tons in the very near future. Cheap organic solvents may provide new liquid media which may in turn lead to a new dyestuff technique in manufacture and application. Cheap alcohols and aldehydes would appear to lead far in many organic syntheses, and if one includes the possibility of cheap hydrogen cyanide the route to many organic acids by a process of addition and hydrolysis is clearly indicated.

Research in the rubber industry, artificial silk, and nitrocellulose varnishes proceeds apace, and in all cases Great Britain is well to the fore. The so-called rubber accelerators, the addition of which in small quantities to the rubber mix enables the rubber manufacturer to control the degree and the speed of vulcanisation in a remarkable manner, are used in ever-increasing variety and quantity. By their use it is claimed that the life of motor tyres has been increased to an extraordinary extent. A late development of an old idea is the addition of organic substances which have the property of preventing hardening on storage, and therefore of prolonging the life of rubber.

It is freely rumoured that one of the newer viscose silk companies has a process whereby is obtained a silk possessing much greater tensile strength when wet than has hitherto been the case. If it is true, then a serious defect of this otherwise wonderful material has been eliminated. The utilisation of viscose and acetyl cellulose silks continues to expand, and their ever-increasing use admixed with cotton and wool as a means of imparting lustre to the somewhat dull natural fibres presents new problems to the dyer and dyestuff manufacturer alike. New dyestuffs made solely to meet artificial silk problems are constantly appearing, and it is gratifying to learn that a new series of British manufacture in this pre-eminently British field are to appear on the market in the early months of 1927.

The nitrocellulose varnishes or lacquers are gaining ground rapidly, and were quite a feature of the recent motor-show.

The problem of obtaining a liquid fuel from coal is receiving the attention of chemists throughout the world. As a nation whose chief natural asset is coal we must have a process, and it is gratifying to know that satisfactory progress is being made.

Range of British-made Dyestuffs

The range of British-made dyestuffs has undergone a normal increase during the year. The British Dyestuffs Corporation has added thirty important dyestuffs, covering every phase of dyestuff endeavour, which were not hitherto made in Great Britain. Other British dyestuff manufacturers have shown similar enterprise. It is doubtful whether the effort, knowledge, and expenditure involved in placing on the market a new colour is generally realised; the expansion indicated represents a considerable measure of achievement.

The year has seen remarkable changes in the affairs of the British dyestuff industry. Early in the year the British Dyestuffs Corporation made an arrangement by which Government control ceased. It then proceeded to set its house in order by a drastic reduction in capital and the concentration of manufacture in the more modern branches. Later it effected an amalgamation with Scottish Dyes, Ltd., whereby the most economic development of the important anthraquinone field was assured. Lastly the amalgamation of Brunner, Mond and Co., Nobel Industries, the United Alkali Co., and the British Dyestuffs Corporation, under the name of Imperial Chemical Industries, Ltd., is in process of completion, and with its formation the British dyestuff industry's great weakness of having all its eggs in one basket will be removed. The present is the age of big business; it has become increasingly apparent during the last few years that the barriers which separated the chemical industry into many phases were artificial.

The following details of the quantities of materials used in the manufacture of a widely used direct black will serve to illustrate the common interests of the chemical industries:—

TO PRODUCE 1 LB. OF COLOUR.

	lb.	oz.	drams.
Sulphuric acid	1	7	0
Nitric acid	1	0	0
Hydrochloric acid	1	1	0
Mixed acid	1	11	0
Oleum	–	13	0
Benzene	1	2	0
Sodium nitrite	–	2	4
Soda ash	1	2	0
Caustic soda liquid	–	7	0
Caustic soda solid	–	6	9
Common salt	8	1	0
Glauber's salt	–	4	0
Benzidine	–	2	0
Zinc dust	–	5	12
Iron borings	1	0	0
Naphthalene	–	3	4
Other chemicals	1	0	0
Coal	8	1	0
Ice	1	0	0

It is, however, in the new chemical field now in process of development that the pooling of experience and general resources of the amalgamated companies will be of chief advantage. This development calls for an expenditure in research and plant which only a trust in the most modern and best sense is capable of providing. Wasteful overlapping is obviated, stability is assured, security to employees is guaranteed, and the ability to meet similar organisations on level terms is at last achieved.

Some Effects of the Coal Strike

On the Chemical and Coal-Carbonising Industries

By a Gasworks Chemist

In attempting a concise account of the results of the coal strike in its relation to the chemical and coal-carbonising industries it must be remembered that both industries are not only largely concerned with coal, but that the by-products resulting from the destructive distillation of this raw material play a very important part. Although chemical manufacturers and the gas industry alike have been able to obtain deliveries of coal, and supplies of gas have been maintained throughout the country, it has only been possible by reason of a certain adaptability, and at a price.

In many cases recourse has been had to coke. This means that more water gas has been made, and less straight coal gas produced. Thus, less tar has been available for distillation, less gas liquor has been produced, and less sulphur (in the form of spent oxide) has been recovered. But this is not all. Large quantities of foreign coal have been carbonised by the gas undertakings of this country. Coal has been imported from America, Belgium, France, Germany, and Silesia. The quality has been variable, but, generally speaking, the American coal has been found to be the most satisfactory and, indeed, the most dependable. It has been low in ash content, satisfactory in its yield of therms; it has produced good coke, but has yielded less ammonia and less sulphur than average English coals. When the foregoing considerations are taken into account, and when it is recalled that the advent of the strike involved the cessation of operations at coke ovens, it is clear that the production of ammonium sulphate and tar has been affected in a sensible degree.

Sulphate of ammonia prices have improved slightly as a result of the shortage. Export figures reveal that there has been a reduction of about 74,000 tons in the first 10 months of this year, as contrasted with the corresponding period of last year. Thus, export customers have apparently found fresh sources of supply. Effort will be needed to regain these temporarily-lost markets.

It is estimated that the tar produced in this country this year will be less by 33⅓ per cent. than in the preceding one. Obviously, the dye industry has been affected. Less benzol, less toluol, and less naphthalene have been available. In order to maintain trade, supplies have been obtained from the Continent at an increased cost.

Prices for tar products stiffened, partially as an outcome of the shortage. Although this increased realisation has been acceptable to gas undertakings, and offsets to a certain extent the enhanced cost of coal, there are other features that cannot be ignored. When abnormal prices obtain for tar and tar products, bitumen has a better opportunity of establishing itself as a road-construction material, and to obviate permanent injury more propaganda work becomes imperative.

The decreased yield of sulphur would have been serious but for the fact that requirements in the matter of sulphuric acid have been appreciably curtailed by reason of the falling-off in the production of ammonium sulphate. It is estimated that the yield of sulphur has been reduced by 40 per cent. where American coals have been carbonised.

The strike has served to emphasise one thing. Coke oven proprietors will find it increasingly difficult to secure a market for their surplus gas unless they take steps to maintain supplies at all times. This involves the carrying of stocks of coal so as to tide over emergency periods. Gas undertakings, relying wholly or partially on coke ovens for their gas, cannot be expected (as the Middlesbrough undertaking did, and as was the case with Leeds, Sheffield, and a number of other undertakings in a lesser degree) to re-establish the gas-making process at a few days' notice. The provision of reserve stocks by the coke ovens would be a protective measure alike for the gas and metallurgical industries.

What are the indirect effects of the strike? The superphosphate industry has suffered. Owing to the coal stoppage, few steamers were operating in the Mediterranean which were willing to bring raw material to this country, for the reason that no return cargoes of coal were available to southern Europe. Freights in October had increased by 100 per cent. as compared with those obtaining in May. This circumstance has constituted a serious hardship to an already-depressed industry.

For similar reasons, it was found that it was impossible to import Sicilian sulphur into this country. For several months none of this raw material arrived.

Trade returns show that the resources of, and the excellent organisation possessed by, the chemical industry have enabled it to resist the effects of the strike more successfully perhaps than any other of its magnitude. True, the total exports for the 10 months ended October 31, 1926, are less by £1,471,688 than in the corresponding period of last year; yet, in the circumstances, they stand at the satisfactory total of £18,562,727.

If, under the most adverse circumstances, trade to the extent indicated can be undertaken, it is safe to assume that under normal conditions the prospects are indeed bright. All that remains is to ensure that capital and labour work harmoniously together, and the future can be approached with every confidence and hope.

Chemical Inventions of the Year

By Our Patents Correspondent

The close of the year again brings us an opportunity of making a general survey of the trend of invention, a survey which, in view of the very large number of patents published every year, and the wide range of subjects dealt with, must necessarily be of a somewhat general character. In this connection it may be of some interest to notice the steady increase in the proportion of patents taken out under the International Convention arrangements—that is, applications made in this country and claiming priority of date in virtue of an earlier application in a foreign country. These inventions are necessarily owned almost without exception by foreigners, and four years ago were about half as numerous as those for which protection was sought here in the ordinary way. This proportion has risen until this year the number of inventions filed under the International Convention is at least equal to those patented as ordinary British applications. When one considers that perhaps half the latter are also of foreign origin and ownership, it will be seen that at least 75 per cent. of British chemical patents are owned abroad. Most of them, as may be expected, originate in Germany.

Hydrogenation of Coal

Probably the most important inventions of the year have been those connected with the hydrogenation of coal and oils, and this subject promises to rival synthetic ammonia as one of the most important advances in the chemical industry in recent years. Practically the whole of the inventions have originated in Germany, and these relate largely to the working details and improvement of the process, the main principles of which are well established. Thus, in one invention, the waste gases from the process, which contain methane and hydrogen, are treated with steam to obtain a gas rich in hydrogen for further use in hydrogenating coal. The methane is converted into hydrogen and carbon monoxide, and the carbon monoxide into hydrogen and carbon dioxide, the latter being then removed. This process is also applicable to coke-oven gases. The effect of the presence of other substances on the hydrogenation has been the subject of considerable research, and patents have been obtained for effecting the hydrogenation in the presence of iron or cobalt, and a nitrogen compound such as ammonia, ammonium sulphide, silicon nitride or titanium nitride, also molybdenum compounds, and various sulphides. Thin oily condensates are obtained. The same methods are also applied to the hydrogenation of crude mineral or shale oils, residues, asphalts, ozokerite, resins, etc., and in these cases hydrocarbons resembling benzene are obtained.

The difficulties due to coking of the coal, tars, oils, etc., in the hydrogenation process can be avoided, according to a further process, by mixing with lignite or peat and employing a catalyst consisting of a molybdenum compound or of roasted pyrites. Tars, oils, asphalts, etc., can be treated in gaseous or finely divided liquid or solid form. The apparatus in this process is of iron coated with chromium or manganese bronze. A variation of the hydrogenation process is that in which the raw material is treated with hydrogen and oxides of carbon or water vapour under high temperature and pressure in the presence of such a contact mass as is used in the synthesis of methanol, *e.g.*, vanadic acid, titanic acid, chromic acid, manganese, zinc, or uranium oxide. In addition to benzene and other liquid hydrocarbons, methanol and other oxygen-containing compounds are obtained.

Methanol

The synthesis of alcohols and other oxygen-containing organic products from hydrogen and oxides of carbon continues to receive considerable attention, mainly in the direction of varying the conditions under which the reaction takes place. Thus in one case, unsaturated hydrocarbons are added to the reacting gases, with the result that liquid hydrocarbons are produced as well as alcohol. The product can be used as a fuel for internal combustion engines. Somewhat similar results are obtained in another process, according to which a mixture of water gas and coal gas is used in place of hydrogen and carbon monoxide, with a catalyst of zinc oxide and chromium oxide. The process can be modified to obtain a high proportion of higher alcohols and their ethers and ketones by eliminating the carbon dioxide and products in a cyclic process, and using particular catalysts, such as a mixture of oxides of silver, copper, zinc, manganese, molybdenum, uranium, or vanadium, with a chromate, manganate, molybdate, tungstate, or vanadate of sodium, potassium, rubidium, or barium. Catalysts of this nature can be freed from deposited sulphur by heating them to redness under oxidising conditions.

In these synthetic reactions, the presence of iron, nickel, or cobalt is shown to be prejudicial, but it has been found that the injurious effect is lost, and a high catalytic effect is substituted if they are present in the form of compounds or solid solutions which will not yield the metal under the conditions of working. Thus iron oxide can be used in conjunction with oxide of chromium, vanadium, tungsten, zirconium, aluminium, or titanium, with which it will form an irreducible compound. Iron itself can be used, alloyed with manganese, chromium, tungsten, tin, or zinc, or combined with silicon, boron, sulphur, phosphorus, or arsenic. The apparatus, of course, must not have any iron parts in contact with the reacting gases, or iron carbonyl may be formed. If, however, the temperature is kept below 150° C. in catalytic reactions such as these, the apparatus may be of iron.

A somewhat similar process has been patented for obtaining compounds of comparatively high molecular weight, such as valeric or butyric acids, isobutyl, propyl, amyl, and higher alcohols and aldehydes, by the interaction of carbon monoxide and the vapours of aliphatic alcohols at high temperature and pressure in the presence of a catalyst. The latter must contain a dehydrating constituent such as oxide of titanium, zirconium, thallium, cerium, chromium, or aluminium, with or without an alkali or alkaline earth metal compound. Hydrogenating catalysts such as copper, silver, or gold may be present also, and nitrogen may be added to the gas mixture, yielding amines in the final product. The nature of the product depends on the temperature and time of the reaction, a high temperature and an extended time favouring the production of substances of higher boiling points. Another inventor obtains alkyl formates by treating an alcohol with carbon monoxide at high pressure and at a temperature of 60° to 100° C. in the presence of a metal alcoholate. In another case a mixture of methane, acetylene, and carbon monoxide is heated to 500° to 950° C., and the product cooled and passed over a catalyst of zinc oxide, active carbon, aluminium, and magnesium powders, yielding hydrocarbons suitable for fuel.

A process of some interest in connection with the utilisation of the products obtained in the synthesis of methanol is that in which the mixed gases and vapours are passed upwards through a chamber containing pinewood, while the liquid products are passed downwards. The liquid products include methanol, pine oil, acetone, isopropyl alcohol, and acetic acid, while the gases include additional hydrogen, carbon monoxide, methane, and ethylene. In another process the liquid products are distilled in vacuo, and the distillate again distilled at atmospheric pressure. The fraction boiling at 66° to 72° C. is boiled with concentrated hydrochloric acid under a reflux condenser. The oily layer is separated, washed with alkali, and steam distilled, yielding a product similar to turpentine oil, boiling at 140° to 155° C.

Ammonia Synthesis

Steady progress is being made in the synthetic ammonia industry, principally in the direction of improvements in the details of the plant and process, and in the subsequent oxidation of the ammonia. One inventor overcomes the difficulties due to the use of high pressures and the necessity of using highly purified hydrogen, by using a large excess of steam in place of hydrogen, and passing the gases over heated iron or lower oxides and hydroxides of iron and nickel. The proportion of steam to nitrogen should be about four to one, and the pressure 30 lb. per square inch. The temperatures may be 200° to 800° C. if nickelous oxide or hydroxide is used, otherwise it should be 450° to 550° C. It has been found that ammonia can be oxidised by a gas rich in oxygen without danger of explosion, if a flat and very narrow reaction chamber is used. Several patents relate to the use of water gas as the source of the nitrogen-hydrogen mixture, notably one in which the mixture obtained by the partial liquefaction of water gas is freed from carbon monoxide by absorption in concentrated alkali solution at 300° C. and 400 atmospheres pressure.

Fertilisers

The manufacture of all classes of chemical fertilisers is well represented in the patents of the year, most of which relate either to a cheapening of the process of manufacture or to the production of the final material in a form which is non-deliquescent and granular. Thus one process reduces the manufacture of superphosphates to a single operation, the process being continuous. Phosphatic rock is ground to 200 mesh and projected into a reaction chamber into which sulphuric acid of 1·840 specific gravity is also sprayed. The product requires no drying and may be packed into bags immediately. Another invention is for obtaining calcium nitrate in a form which does not readily become moist. A 75 per cent. solution of calcium nitrate is calcined and almost completely dehydrated, then transferred to a cooler and mixer and a small proportion of calcium nitrate crystals added. Incidentally, the difficulty of obtaining solid calcium nitrate from a hot highly concentrated solution by the usual methods can be avoided by adding about 1·7 to 5 per cent. of ammonium nitrate. Solidification, which occurs at a higher temperature than usual, is brought about by stirring or spraying. A dry granular mixture of calcium nitrate and urea in the molecular proportions of 1 : 4 can, according to another invention, be obtained by spraying the hot solution into a stream of gas.

Ammonium bicarbonate would be a very useful fertiliser if it could be stored and shipped without loss due to its volatility, and a method for accomplishing this has now been discovered. It has now been found that the usual high volatility is due to the presence of a small proportion of ammonium carbonate or carbamate, or double or triple salts with bicarbonate. Pure bicarbonate is only obtained by crystallising from a hot solution while continuously passing in carbon dioxide, and not by saturating aqueous ammonia or ammonium carbonate with carbon dioxide while cooling. Carbon dioxide is therefore passed into 12 to 15 per cent. aqueous ammonia which is kept hot until crystallisation occurs. It has also been found that the density and stability of the product can be increased by the addition of substances which influence the surface tension, such as benzene, petrol, tar oils, ammonium sulphide, naphthalene, sulphonic acids, etc. Tar oil is the most suitable if the product is to be used as a fertiliser, or carbon tetrachloride or sugar if required for the manufacture of baking powder.

A synthetic product of some interest is that obtained by combining carbon monoxide and chlorine to form phosgene and then injecting ammonia. If four volumes of ammonia and one volume of phosgene are employed, the product consists of ammonium chloride and urea, but if less ammonia is used cyanamide and cyanuric acid are produced. It is of interest, although not perhaps to the manufacturer of fer-

tilisers, that pure urea can be obtained from commercial urea by treating a concentrated solution with oxidising agents in the presence of 0·5 to 1 per cent. of ammonia. In another patent urea is obtained in a sandy form, particularly suitable for distribution, by spraying a solution of 90 to 95 per cent. strength by means of an air jet at a pressure not above 100 mm. of water. The drops of solution solidify to give a sandy product. A higher pressure of air would give a product too finely divided for satisfactory use as a fertiliser.

Several improvements have been noted in apparatus for neutralising the acidity of ammonium sulphate with greater convenience, and for obtaining it in a granular form and of good colour. In one case a process has been patented depending on the treatment of a saturated alkaline solution of ammonium sulphate with gas liquor containing hydrogen sulphide and the utilisation of this for neutralising crude ammonium sulphate.

Pigments

Considerable research has again been evident in regard to pigments and their use in the manufacture of paints. Investigations into the variability of quality of titanium pigments show that it is due to the size of the particles from which the oxide is formed. Good results are obtained when the particles are so graded that the spaces between the larger particles are practically filled by the smaller, and colloidal products having these properties can be obtained. In another case the durability of titanium pigments is increased by the addition of thorium compounds. Several inventions relating to iron oxide pigments have been patented, including one in which a very finely divided oxide is obtained by igniting a mixture of iron carbonyl vapour and air. This oxide is also suitable for use as a catalyst, or for making finely divided iron. In another case ferric oxide is produced continuously from waste pickle liquor by atomising it into heated air. Some experiments on the production of "blanc fixe" have shown that it can be satisfactorily obtained from barium sulphide instead of barium chloride if about 10 to 15 per cent. of the sulphide is first converted into the hydrosulphide. This can be done by adding an acid or acid salt to the sulphide.

Iron Carbonyl

The recognition of the value of iron carbonyl for imparting "anti-knock" properties to fuel for internal combustion engines has inspired several inventions for its production on a commercial scale. One invention employs iron obtained by reducing oxygen compounds of iron at moderate temperatures, and carbon monoxide is passed over the iron at 100° to 200° C., and 50 atmospheres pressure. The speed of the gas must be such that deposition of iron carbonyl on the iron is prevented. Lower pressures down to atmospheric pressure can be used if the speed of the gases is increased sufficiently to prevent deposition of liquid iron carbonyl. The issuing gas contains 8 per cent. of $Fe(CO)_5$, which is condensed by cooling under water or by absorption. The activity of the iron can be increased by the presence of a small proportion of ammonia, methanol, or formaldehyde. When high pressures are used, with temperatures above 140° C., the yield can be increased if the temperature of the gases leaving the apparatus is reduced before releasing the pressure.

Dyestuffs

The work published in connection with organic dyestuffs shows no reduction in quantity as compared with previous years. On the whole it is concerned with the further elaboration of known fields rather than the discovery of new ones. The azo dyes continue to attract almost as much interest as ever, principally in connection with the mordant and acid wool dyes; noteworthy are those derived from the diarylsulphones and diarylsulphides and which possess the valuable property of being but little changed in shade by after-chroming. A number of new derivatives of 1-phenyl-5-pyrazolone and level-dyeing azo dyes for wool derived therefrom have also been described, and also a few simple azo dyes especially suitable for dyeing cellulose esters. Considerable attention is still being given to the production on the fibre of azo dyes from 2 : 3-oxynaphthoic arylamides and certain arylamides of acetoacetic acid (naphthol A S and various marks thereof); the recently published specifications deal chiefly with the selection of diazo compounds to produce particular shades or dyeings of exceptional fastness; an interesting feature is the use of these dyestuffs in conjunction with vat dyestuffs for the production of fast mixed shades. The demand for dyestuffs really fast to the various influences to which they may be subjected has resulted in undiminished interest in the anthracene vat dyestuffs and particularly in those of the perylene and pyrene series. To the former series belong dibenzanthrone and isodibenzanthrone, and to the latter pyranthrone and a new series of yellow dyestuffs which are probably derivatives of dibenzopyrenequinone. New methods are described for the production of dibenzanthrone and isodibenzanthrone and various new halogenated- and alkyloxy-derivatives. A few advances are to be recorded in the thioindigoid series, but these are, with the exception of the interesting anthracene and anthraquinone thioindigoid dyes, limited to the production of various isomers of known thioindigoid dyes. Mention must be made of the work done by Messrs. Scottish Dyes, Ltd., on the soluble derivatives of leuco-vat-dyes, the first member of which was the well-known Indigosol (Durand and Huguenin); they have devised new methods of producing these interesting compounds, and have also described specifically and placed on the market such derivatives of anthracene vat dyestuffs under the name of "Soledon" colours. There has been a diminution in the number of patent specifications published in connection with the dyeing of cellulose ester artificial silks; the majority of those published relate to the selection of particular classes of dyestuffs usually well known though comparatively useless for other purposes.

General

The chemistry of indiarubber, particularly in regard to the influence of accelerators on vulcanisation, is well represented in the patent literature. Several new accelerators have been patented, notably one obtained from acetaldehyde and amines such as aniline, *n*-butylamine and ethylamine; in another case diaryl-thioureas are prepared containing an alkylated amino group in each of the aryl residues, and these are desulphurised. Diaryl guanidines containing an alkylated amino group in each of the aryl nuclei have a greater accelerating action compared with the diaryl guanidines.

Several inventions for the production of acetic acid, acetic anhydride, and cellulose acetates have been published, mainly in connection with the artificial silk industry. One process of interest is that in which acetic anhydride is obtained by subjecting acetic acid vapour to the action of heat, and immediately separating the anhydride from the water vapour by fractional condensation. In another case highly concentrated or glacial acetic acid is passed over oxides or carbonates of barium, calcium, or zinc, which must be free from water, to obtain the anhydride. Dilute acetic acid under similar conditions yields acetone. Another process for obtaining acetic anhydride depends on the passage of acetic acid vapour over water-binding agents, such as bisulphates or pyrosulphates of alkali or alkaline earth metals, and zinc chloride, but not calcium chloride or sulphuric acid.

In the manufacture and purification of hexamethylene tetramine, several improvements have been made in the plant and in the process of separating the product from the associated ammonium chloride. It has been found that by charging the solution with ammonia gas the solubility of hexamethylene tetramine is reduced to 10 to 15 per cent. of its solubility in water, while the solubility of ammonia is increased, so that the two salts may be readily separated by this means. This is applicable to a mixture of dry salts obtained by treating methylene chloride with liquid ammonia, or to a wet mixture. In the process in which formaldehyde is treated with ammonia the use of an excess of ammonia will precipitate 90 per cent. of the hexamethylene tetramine.

An interesting invention for solidifying liquids, according to which, among other applications, alcohol can be obtained in a solid form which burns without melting, has been published. The liquid, *e.g.*, alcohol, castor oil, hydrocyanic acid, chloroform, benzene, xylene, or ammonia, is mixed with a little magnesium alcoholate and water, and the mixture sets to a jelly.

Other inventions of interest which have been noted include several for the purification of catalysts from sulphur, iron carbonyl and other "poisons"; for the manufacture of highly active nickel and iron catalysts, for use in the oxidation of oils, tars, etc., to obtain aldehydes, acids, and alcohols; for the direct conversion of hydrated magnesium chloride to the

anhydrous form, and the direct electrolysis of the hydrated form to obtain magnesium; for making and reactivating active carbon, silica gel, and other adsorbents; for increasing the output and reducing the costs in sulphuric acid manufacture; for obtaining potassium salts from sea water; for obtaining camphene, isoborneol, and camphor; and for converting mercury into gold by passing electric sparks from it into a dielectric.

A Chemical Diary for 1926

Below we give a summarised diary of the principal chemical events of 1926. The entries include some matters of quite abnormal interest, such as the general and coal strikes, the formation of Imperial Chemical Industries, Ltd., the London Congress of Chemists, etc.

January

Dyers' Company's Research Medal for 1924–25 awarded to Dr. F. M. Rowe, F.I.C.

Institution of Fuel Economy Engineers formed.

Annual Exhibition of scientific apparatus by the Physical Society of London and the Optical Society.

Third Duddell Medal awarded by the Council of the Physical Society of London to Mr. Albert Campbell, B.A., late of the N.P.L.

Opening of new metallurgical laboratories of the Pittsburgh Experiment Station of the U.S. Bureau of Mines.

Gift of £2,500 accepted by the Society of Glass Technology from the Glass Research Association.

First issue of the Dyestuffs Monthly Supplement published in THE CHEMICAL AGE.

Donation of 2,500 dollars given by the du Pont Co. to the American Chemical Society towards cost of publishing the Decennial Index of *Chemical Abstracts*.

Obituary.—Dr. Erich Krause; Mr. F. H. Wilkinson, of Blackburn; Mr. Andrew Fisher M'Callum, of Paisley; Mr. William Hampson, M.A., a distinguished member of the Rontgen Society; Alderman John Harrison, twice President of the Pharmaceutical Society.

February

Conference of metallurgical students, representative of the whole body of University-trained metallurgists in the U.K., discussed "The Position of the Metallurgical Student in Industry."

British Industries Fair, White City, London, and Castle Bromwich, Birmingham.

Dr. Alfred Rée appointed director of the British Dyestuffs Corporation.

Boverton Redwood Medal awarded to Mr. C. H. McCarthy-Jones, for the sessions 1923–24 and 1924–25, by the Institution of Petroleum Technologists.

British Drug Houses, Ltd., converted into a public company.

Fifth Annual Dinner of the London section of the British Association of Chemists.

Second Japanese Chemical Exhibition, Tokyo, Japan.

Obituary.—Mr. W. P. Harris, director of J. Crosfield & Sons; Dr. Karl Goldschmidt; Sir J. B. Harrison, F.I.C., of Demerara, a director of the Department of Science and Agriculture in British Guiana; Dr. L. Tietjens, director of the laboratory of the German Potash Syndicate; Professor H. K. Onnes, Emeritus Professor and Director of the Physical Laboratory at Leyden University.

March

Annual Dinner of the Oil and Colour Chemists Association.

Agreement arranged between the British Dyestuffs Corporation, Ltd., and Scottish Dyes, Ltd.

Meldola Medal of the Institute of Chemistry presented to Dr. Henry Phillips.

Donation of £30,000 by Mr. S. A. Courtauld towards the endowment of a New Institute of Bio-chemistry at the Middlesex Hospital.

Research Laboratory at Dudley House, Covent Garden, London, established by the Department of Scientific and Industrial Research.

Formation of the Institution of Fuel Technology.

Dr. E. C. Edgar appointed principal of Rutherford Technical College.

Publication of Coal Commission Report.

New element occupying the sixty-first place in the Periodic Classification reported to have been discovered by Dr. B. S. Hopkins ("Illinium").

Gold Medal of the Institution of Mining and Metallurgy awarded to Sir Robert Kotzé.

High Court sanctioned scheme for reduction of British Dyestuffs Corporation capital by £4,421,532.

Annual meeting of the United Alkali Co., Ltd., at Liverpool.

Sir Max Muspratt appointed President of the Federation of British Industries.

Chemical Society's Annual Meeting at Manchester, first to be held outside London.

Professor H. B. Baker, F.R.S., elected President of the Chemical Society.

Dr. F. M. Rowe succeeded the late Professor E. Knecht in the Department of Applied Chemistry at Manchester College of Technology.

A new glass, known as Lamplough's Vitaglass, produced at the Darnall Research Laboratories, Sheffield University.

Obituary.—Mr. J. A. Radford, Secretary of the Midland Pharmaceutical Society; Mr. J. R. Hoyle, of Thomas Firth & Sons, Ltd.; Mr. Edward E. Arnold, founder of Mathieson Alkali Works; Mr. W. R. Cooper, M.A., A.I.C., consulting engineer and editor of *Science Abstracts*.

April

British Optical Convention, Imperial College, South Kensington, London.

Dr. Daniel Hanson appointed to the Chair of Metallurgy at Birmingham University in the place of Professor T. Turner, retired.

Bessemer Gold Medal of the Iron and Steel Institute awarded to Sir Hugh Bell.

New process by Dr. G. N. White for colouring cement with organic dyestuffs.

A Thomas Henry Huxley Memorial Lectureship founded by the governing body of the Imperial College of Science, London, to be delivered annually at the College for the next five years on May 4.

First British Artificial Silk Exhibition, Holland Park, London.

Conference of representatives of European Nitrogen Works at Biarritz.

Annual meeting of the British Science Guild.

Obituary.—Mr. Andrew T. Smith, general manager of the Castner Kellner Alkali Co., Ltd.; Professor W. J. Lewis, F.R.S., Professor of Mineralogy at Cambridge University; Mr. Charles Harrison, head of the Oils and Colours Department at the Borough Polytechnic Institute.

May

Second report of the Adhesives Research Committee by the Department of Scientific and Industrial Research.

Coal Strike commenced May 1.

General Strike declared May 4. Called off May 12.

Thomas Turner Gold Medal presented to Sir Gerard Muntz.

Mr. H. Lambourne appointed Head of the School of Chemistry at the Polytechnic, Regent Street, London, in succession to Dr. E. C. Edgar.

A research laboratory to be known as the National Association Institute of Cleaning and Dyeing to be constructed at Washington.

Dr. F. M. Rowe, D.Sc., F.I.C., elected to the Chair of Colour Chemistry and Dyeing at Leeds University, in succession to Professor A. G. Perkin, F.R.S.

Report of the National Physical Laboratory for 1925.

Annual meeting of Brunner, Mond & Co.

Obituary.—Mr. Henry Ripley, of the Bradford Dyers' Association; Mr. Frederick S. Spiers, Secretary of the Faraday Society; Mr. Richard Isherwood, one of the pioneers of the heavy chemical industry.

June

Sixty-second annual report on Alkali Works by the Chief Inspector.

Opening of the new buildings of the Department of Oil Engineering and Refining, at Birmingham University, by Sir John Cadman.

I. G. Dyestuffs, Ltd., registered on June 28 as a private company with a nominal capital of £25,000 in £1 shares.

Obituary.—Mr. W. P. Thompson of Liverpool; Mr. H. S. Willcocks, of Manchester; Mr. Ignatius Singer, analytical chemist to the Bradford Dyers' Association.

July

London Congress of Chemists. Annual meeting of the Society of Chemical Industry. Mr. F. H. Carr elected President.

Messel Memorial Medal of the Society of Chemical Industry presented to Earl Balfour.

Chemical Plant Exhibition, Central Hall, London.

Exhibition of Laboratory apparatus, etc., at the Institute of Chemistry, London.

Annual general meeting of the Institution of Chemical Engineers.

Symposium on "Corrosion" under the auspices of the British Chemical Plant Manufacturers' Association, Institute of Metals, Institution of Chemical Engineers and the Chemical Engineering Group of the S.C.I.

THE CHEMICAL AGE reception in connection with the opening of Bouverie House, the new headquarters of Benn Brothers, Ltd.

Third report of the Joint Benzol Research Committee.

Mr. A. Hutchinson, M.A., F.R.S., elected to the Professorship of Mineralogy in the University of Cambridge.

Celebrations in connection with the coming-of-age of Sheffield University. New engineering and metallurgical laboratories opened by Sir Robert Hadfield.

Annual meeting of the British Chemical and Dyestuffs Traders' Association.

Dr. G. H. Christie appointed Lecturer in Chemistry in the Durham Colleges of the University of Durham.

Mr. D. H. Bangham resigned the position of Lecturer in Chemistry in the University of Manchester on his appointment to the chair of Physical and Inorganic Chemistry in the Egyptian University, Cairo.

Annual meeting of the British Dyestuffs Corporation: a profit of a quarter of a million and the recommendation of a 2½ per cent. dividend.

Twelfth annual general meeting of the Mond Nickel Co.

Mr. George Patchin, A.R.S.M., appointed Principal of the Sir John Cass Technical Institute, London, in place of Dr. Charles A. Keane, resigned.

Annual meeting of the Colour Users' Association.

Dr. E. C. Pickering appointed Head of the Chemistry Department, Borough Polytechnic Institute, in succession to Mr. H. Lambourne.

Formation of Steel Trust in Germany, known as Vereinigte Stahl Werke A. G. Dusseldorf (United Steelworks).

I. G. absorbed Koln-Rottweil Gesellschaft. Agreements arranged with the Dynamit A. G. and the Rheinisch-westfalsche Sprengstaff A. G.

Fourth annual report of the Safety in Mines Research Board for 1926.

Professor Paul Sabatier presented with Royal Society of Arts' Albert Medal.

Obituary.—Mr. John Christie, J.P., of Alexandria, Dumbartonshire, a dyestuffs pioneer; Mr. J. H. F. Hill, one of the original members of the Institution of Chemical Engineers; Mr. Montagu G. Smith, President of the Drug and Chemical Union.

August

Professor J. F. Thorpe, F.R.S., appointed by the Secretary of Mines to be chairman of the Explosives in Mines Research Committee, in the place of Sir Frederic L. Nathan, resigned.

Annual meeting of the British Association for the Advancement of Science at Oxford. Presidential address (Chemical Section) delivered by Professor J. F. Thorpe on "The Scope of Organic Chemistry."

Particulars of British interests in the Bergius Coal-Oil Process published August 7.

Appointment of Mr. F. Scholefield, M.Sc., F.I.C., and Dr. F. A. Mason to the staff of the Manchester Municipal College of Technology.

New National Fuel and Power Committee appointed by the President of the Board of Trade.

New China Clay Association registered.

Benn Brothers, Ltd., annual meeting.

Obituary.—Mr. James Stewart, for several years editor of *The Gas World*; Dr. Dierksen of the Badische Anilin- und Sodafabrik; Mr. Allin Cottrell, lecturer on Technical Chemistry in Edinburgh University.

September

American Chemical Society: Fiftieth Anniversary celebrations in Philadelphia. Pilgrimage to Dr. Joseph Priestley's grave.

Autumn meeting of the Institute of Metals at Liege.

Smoke Abatement Conference in Birmingham.

Sir Frederick Keeble, Sherardian Professor of Botany in the University of Oxford, accepted appointment with Synthetic Ammonia and Nitrates, Ltd.

Government Chemist's annual report.

Annual report of the Chief Inspector of Factories and Workshops for 1925.

Sir James Irvine, Principal and Vice-Chancellor of the University of St. Andrews, awarded the Willard Gibbs' Gold Medal of the American Chemical Society.

Association of Special Libraries and Information Bureaux: third conference at Balliol College, Oxford.

Centenary celebrations of Cannon Iron Foundries, Ltd.

Annual meeting of Nobel Industries.

Opening of new offices of the United Alkali Co. at its Allhusen Works, Gateshead.

Mr. G. W. Douglas, of Ilkley, appointed State Chemist to take charge of the Government Laboratories at Bhopal.

Mineralogical Society of Great Britain and Ireland Jubilee celebrations.

Research Association of the British Paint, Colour and Varnish Manufacturers registered.

Sixth International Congress of Industrial Chemistry, Brussels.

Obituary.—Mr. W. Jamieson, director of the Broken Hill Proprietary Co., Melbourne; Mr. F. G. Lomax, chairman of the Chilean Nitrate Commission; Dr. C. W. Eliot, formerly Professor of Chemistry in the Massachusetts Institute of Technology; Wilhelm Schranz, of the I. G. Farbenindustrie A.G. at Elberfeld; Mr. F. E. Atteaux of Boston; Dr. W. L. Uglow, Professor of Mineralogy at the University of British Columbia.

October

Anglo-German Industrialists' Conference, London.

Amalgamation of Ernest Benn, Ltd., and T. Fisher Unwin, Ltd.

Freedom of Leeds conferred upon Colonel Sir Edward Brotherton, Bart.

Professor J. W. McBain accepted appointment at Stanford University, California.

Dr. J. H. Simons appointed Professor of Chemistry in the Northwestern University, Chicago.

Lead Manufacturers' Association formed.

U.S.A. Government action against Chemical Foundation finally dismissed.

Decision to amalgamate the coal tar and pure chemistry departments of Huddersfield Technical College.

China Clay Association dissolved.

International Union of Pure and Applied Chemistry at Washington, U.S.A.

Announcement of proposed amalgamation under new title of "Imperial Chemical Industries," of Brunner, Mond and Co., Nobel Industries, the United Alkali Co., and the British Dyestuffs Corporation.

Northern Coke Research Committee formed.

Obituary.—Dr. Franz Goldschmidt, editor of the *Zeitschrift der Deutschen Öl- und Fett- Industrie*; Dr. E. S. Breidenbaugh, Professor of Chemistry in Gettysburg College; Mr. J. E. C. Lord, managing director of J. E. C. Lord (Manchester), Ltd.; Dr. E. C. Porter, Works Chemist at a shoe factory in Stafford; Professor A. Gutbier, Professor of Chemistry in and Rector of the University of Jena; Mr. Leonard Carpenter; Mr. William Spiller, F.I.C.

November

Annual Chemical Dinner, London.

International Fuel Conference, Carnegie Institute, Pittsburgh.

Hurter Memorial Lecture, Liverpool, by Dr. E. F. Armstrong.

Death of Mr. and Mrs. Roscoe Brunner.

Annual Meeting of the British Association of Chemists.

Ninth Annual Streatfeild Memorial Lecture by Mr. F. C. Robinson.

Coal Products, Chemical and Engineering Exhibition, Manchester.

Manchester Conference on "Tar."

Gift of £10,000 by Sir Alfred Yarrow to the British Association for the Advancement of Science.

Grant of £25,000 by the Privy Council for Scientific and Industrial Research for research in Cambridge.

Royal Society Medals.—Royal Medals: Sir William Hardy, Professor A. V. Hill; Copley Medal: Sir Frederick Hopkins; Rumford Medal: Sir Arthur Schuster; Davy Medal: Sir James Walker; Darwin Medal: Dr. D. H. Scott; Hughes Medal: Admiral Sir H. Jackson.

Nobel Prize for Chemistry for 1925 awarded to Professor Richard Zsigmondy, of the University of Gottingen. The 1926 Prize to Professor Svedberg, of the University of Upsala. The 1925 Prize for Physics divided between Professor J. Franck, of Gottingen, and Professor G. Hertz, of Halle. The 1926 Prize for Physics awarded to Professor Jean Perrin, of the Sorbonne.

Armstrong College, Newcastle, promised a grant of £20,000 from the Miners' Welfare Central Committee for a new mining laboratory.

Dr. Louis A. Jordan appointed Director of Research to the Research Association of British Paint, Colour and Varnish Manufacturers.

Sixth Annual Meeting of the British Sulphate of Ammonia Federation.

Nitram, Ltd., formed to be the sole selling and propaganda agents of the British Sulphate of Ammonia Federation.

Explosion at Hickson and Partners' Works, Castleford.

End of the Coal Strike.

Obituary.—Percy W. Cole, of Cole and Wilson, Huddersfield; Mr. M. Sissons, of Hull; Mr. Albert Shonk, assistant editor of *British Chemical Abstracts*; Dr. E. R. Watson, principal of the Technological Institute, Cawnpore; Sir Ellis Griffith, a director of the Mond Nickel Co.; Mr. W. N. C. Allen, representative of the Bradford Dyers' Association in China for nearly 20 years.

December

Sir T. M. Legge, H.M. Senior Medical Inspector of Factories, resigned position as from November 30.

Mr. C. J. T. Cronshaw, of the British Dyestuffs Corporation, appointed a member of the Dyestuffs Industry Development Committee in place of Dr. A. T. de Mouilpied, resigned.

Imperial Chemical Industries, Ltd., registered December 7.

Autumn Meeting of the Institution of Fuel Technology.

Institution of Chemical Engineers' Conference.

Naylor Bros. (London), Ltd., Annual Conference Dinner.

Professor Rolla of Florence claimed to have discovered Element No. 61, to which he has given the name Florentium.

British Cast Iron Research Association's Annual Meeting.

Obituary.—Dr. Richard Meyer, Professor of Chemistry in the Brunswick Technical High School; Sir William Tilden, F.R.S.; Mr. Roger W. Wallace, K.C.

"Peace—Industrial and International"

THE annual dinner of Arthur Duckham (1920), Ltd., was held at the Trocadero Restaurant, London, on December 23. The chairman of the company (Sir Arthur Duckham) presided. There were present over 180 members of the staff. After proposing the loyal toasts, Sir Arthur said that there was one further toast which he would like to give, namely, "Peace—Industrial and International." He felt that the prosperity of the country, and indeed the company collectively and individually, depended upon the general acceptance of international peace and peace in industry. Subsequently, Sir Arthur took the opportunity of congratulating the staff on having brought to commercial success a number of important developments upon which they had been engaged during the past few years.

Synthetic Muskone

Perfuming Principle of Natural Musk

MUSKONE, the perfuming principle of natural musk, is now being produced in sufficient quantities for sale under the trade name of Exaltone. The completion of this synthesis marks the successful conclusion of a series of researches extending over a number of years and costing in the aggregate several hundred thousand dollars, according to the statement of the firm of M. Naef and Co., of Geneva. Since the earliest days of synthetic chemistry, the problem of the perfuming principle of natural musk has been a fascinating one for chemists, not only because of the difficulties involved, but because of the financial rewards awaiting their successful solution, owing to the scarcity and high cost of natural musk. All attempts to isolate the perfuming principle in any reasonable degree of purity were unsuccessful. The earlier investigators isolated something which they called muskone and which they described as a heavy, oily liquid, but the appearance and character of this isolation product rendered it highly probable that it represented a mixture rather than a pure substance, and the attempts to further purify and crystallise it met with no success.

Muskone and Civetone

Owing to the cost of natural musk and the very small amount of perfuming principle present in it, a little more than 1 per cent., it was prohibitively expensive to isolate any large quantity of it as a basis for investigations. Fortunately, however, it was found that the perfuming principle of civet, to which was given the name civetone, was obtainable in larger quantities at a lower cost, and appeared to be sufficiently close in chemical constitution to muskone to make it a useful starting point for scientific research. Working on this basis, M. Naef and Co. not only conducted research work in their own laboratories, but financed investigations of different aspects of the problem in several European universities. It very soon became evident that the perfuming principles both of musk and civet were bodies of a cyclic constitution containing at least one ketone group and a large but indefinite number of carbon atoms, certainly not less than nine.

The key to the solution of the problem was found when Dr. Philip Chuit, of M. Naef and Co., prepared cyclic ketones containing from 9 to 18 carbon atoms in a ring by the pyrogenetic decomposition of the thorium salts of the corresponding polymethylenedicarboxylic acids. An examination of the ketones thus prepared showed that those containing 10 to 12 carbons in a ring had a camphoraceous odour, while those having 14 to 18 carbon rings had an odour similar to that of musk. Of these the ketones with 14 and 15 carbon rings had an odour almost identical with muskone, while higher members of the series corresponded more closely with the odour of civet. Ketone C-17 was found to be exactly identical with dihydrocivetone obtained by the hydrogenation of civetone.

The Synthetic Product

Ketone C-15, chemically known as cyclopentadecanone, is identical with muskone and, as previously mentioned, is now available under the trade name of Exaltone. It is the chemically pure perfuming principle of natural musk, which exists, even in the finest grade of Musk Tonquin Grain, only in the proportion of 14 parts per 1,000. Even to-day, with an exact knowledge as to the constitution and methods of preparation of muskone, its manufacture on a commercial scale offers tremendous technical difficulties, and the total production must still be measured in ounces rather than in pounds. Exaltone itself apparently has little odour and it is only when it is diluted in the form of a tincture, 1 part to 1,000, that its true musk character becomes apparent. Its relation to natural musk is much like that of vanillin to vanilla beans, with the difference that the vanilla bean does contain measurable, though small, proportions of other valuable ingredients, whereas investigation shows that natural musk contains no perfuming ingredients of value except the muskone which has now been duplicated synthetically.

Plant for Ribbon Dyeing

AN inquirer is anxious to be put in touch with manufacturers who could supply a small ribbon dyeing plant. Particulars may be obtained on application to THE CHEMICAL AGE.

D

Chemical and Allied Societies

Notes on Their Work During 1926

Association of British Chemical Manufacturers

The many-sided interests of the Association have been amply displayed in the work of the past year. Concurrent with the work of the individual groups, the Association as an entity took responsibility for the Chemical Section of the London branch of the British Industries Fair held in February, and so helped to create a success which has justified a repetition of the Fair in 1927; for this the Association have already received orders for all the space at its disposal. There have been repeated inquiries for the loan of the publicity films on chemical industry, by foreign and colonial cinemas in particular.

The Research Committee of the Association have been engaged on the problem of specifications for chemical lead and have been able to forward to the British Engineering Standards Association some very valuable criticisms and suggestions.

The Factories (No. 2) Bill has interested most members of the Association and a number of criticisms and suggestions have been received since the matter was referred to the various groups. The decision of Parliament that the Bill should not be dealt with this session has been met with great satisfaction by those who realise the effect of its becoming law at such a critical period in industry.

The work of the groups has been carried through by frequent meetings, and the events of the past twelve months have brought with them a number of problems which have interested all sections of the Association. Throughout the year the fine chemical group have been engaged on one or another aspect of the Safeguarding of Industries Act, beginning with a preparation of a case in favour of a continuance of the Act, and continuing with proposals for the amendment of List "H," which in view of the still rapidly increasing activities of the fine chemical manufacturers has proved to be of a very complicated nature.

In addition this group issued at the commencement of the year a comprehensive list of fine chemicals then manufactured by members of the group, together with names of the makers.

After exhaustive consideration by the Alcohol and Methanol Committees, the Association were able to put forward to the Interdepartmental Alcohol Committee very valuable written and oral information for the use of the Committee in deciding the question of the desirability or otherwise of making alcohols other than ethanol dutiable, and that of the revision of the out-of-date and detrimental legislation on methanol.

The Traffic Committee has continued to watch the general and special interests of the Association and has obtained valuable concessions with respect to the carriage of dangerous goods, especially in the packing and conveyance of chemicals for overseas trade; useful information of continental traffic conditions has been made available to the Association, and representations to the railway companies on the problem of retention of owners' tank wagons have effected a considerable improvement of conditions in the mode of transport. Various useful modifications have been obtained in the classification of chemicals for transport; and, finally, the committee have continued to keep in close touch with the proceedings of the Railway Rates Tribunal throughout the year.

The Association have prepared for the press a new edition of the Official Directory, and considerable improvement has been made in the arrangement of the subject matter in the new issue. The volume will be published early in the New Year, and in view of its very recent revision will prove of valuable use to all interested in chemical manufactures, whether manufacturer, consumer, or agent, at home or abroad.

A volume of this nature cannot, of course, be completely exclusive and inclusive, and its use is suggested in conjunction with the booklet "Some British Fine Chemicals," and if necessary the information bureau of the Association.

The Tar Section.

The Tar Section of the Association (Group V) has continued to work in conjunction with the Association of Tar Distillers in matters of interest to this branch of the chemical industry. At the general meeting in June Mr. C. G. Lyon (of Stainsby and Lyon, Ltd.) was elected president, Mr. T. Howard Butler (of William Butler and Co. (Bristol), Ltd.) vice-president, and Mr. J. H. Olliver, of the Gas Light and Coke Co., honorary treasurer.

The action of the Association in connection with the embargo on pitch was a material factor in preventing what would otherwise have been a criticial position in the export trade of this commodity, and in thus ameliorating a very acute condition in the world supply of pitch.

The Pitch Research Sub-Committee have developed an intimate relationship with the work now being undertaken by the Department of Scientific and Industrial Research on the constitution of pitch, and have assisted with advice on the working, with promises of supplies of coal and pitch for use in the research, and with a valuable monetary contribution.

The November meeting was held in Manchester concurrent with the Tar Symposium on the 26th of the month, and members were thereby enabled to attend the reading of the papers on tar problems given in connection with the Coal Products Exhibition (November 16 to 27).

British Chemical Plant Manufacturers.

At the July annual general meeting of the Chemical Plant Manufacturers' Association Dr. R. Seligman (of the Aluminium Plant and Vessel Co., Ltd.) was elected chairman and Mr. J. A. Reavell (of the Kestner Evaporator and Engineering Co., Ltd.) was elected vice-chairman.

The propaganda campaign inaugurated last year against the bias for foreign plant has been successfully carried on through the year by the issue of a Directory, by advertising in the technical press, by correspondence, and more especially by the organisation of the unique exhibition held coincident with the Chemists' Congress in July. The unqualified success of this exhibition, in spite of extreme difficulties and the diminished numbers of provincial visitors in view of the coal strike, called forth a large amount of praise, as well as the more useful practical results that were originally sought.

The development of the Association as a contact point between inquirers for plant and suitable manufacturers has proceeded satisfactorily throughout the year, and the service has been found exceptionally useful in cases where the classification in the Directory of the Association is not sufficiently definite. A continually increasing amount of information concerning manufacturers of specialised and occasional requirements is continually being collected, and in no case on record has it been found necessary to go outside England for any type of plant for which inquiries have been made. In fact, progress has been made on such lines that the problem before the inquirer has, in many cases, developed from that of finding a British manufacturer to that of choosing from a list of alternative makers. Manufacturers have also realised still more fully the importance of adapting themselves to buyers' requirements, and it has been particularly gratifying to be able to inform firms who have made inquiries through the offices of the Association that one or more members are willing to undertake other than routine work on their behalf. There is still room for more development in this way, however; in fact, only in this direction is it possible to say that the British chemical plant manufacturer is appreciably behind in the methods he uses in commanding a share in the world markets.

Co-operating with the Association of British Chemical Manufacturers, the Association has been engaged in a consideration of draft specifications for chemical lead and regulus metal prepared by the British Engineering Standards Association as mentioned above, and a special Chrome-Alloys Sub-Committee has investigated the properties of a number of chrome-alloys and prepared a report.

Oil and Colour Chemists

The year 1926 has seen a steady development in the activities of the Oil and Colour Chemists' Association, and the membership continues to increase. In order to stimulate the interest of the younger generation in the scientific aspects of their calling a new class of membership—known as junior

membership—was created during the year. Junior membership is restricted to those under twenty-one years of age, and these pay only half the usual annual subscription.

One of the outstanding events of the year in the paint and varnish industries has been the formation of the Research Association of British Paint, Colour and Varnish Manufacturers which was inaugurated at a meeting held in London on April 14. The need for a scheme of organised research has been consistently and repeatedly urged by the Association for many years, in particular by Dr. H. Houlston Morgan, who was President during 1924 and 1925, and who has become a member of the first council of the newly formed Research Association.

The sub-committee and panels of the British Engineering Standards Association which are engaged on the difficult task of preparing specifications for paint materials, paints and varnishes have made good progress during the year. Fourteen specifications have been issued and several others are nearing publication. The Oil and Colour Chemists' Association is well represented on these bodies, both directly and indirectly. The Chairmen of the Committee (Dr. J. Newton Friend) and of its three panels (Mr. C. A. Klein, Dr. H. Houlston Morgan, and Dr. G. Rudorf) include a past president, a vice-president, and the President of the Association.

The Manchester Section of the Association, which came into being at the end of 1925, has made good progress during the year, and the interest which has been shown in the movement has fully justified the expectations of its founders. Several meetings and social functions have been held, and the following papers have been read: "Some Dyestuffs Used in Lake Making," F. M. Rowe; "The Drying of Oils," J. Allan; "The Minerals of Derbyshire," W. A. Allsebrook; "The Application of a Coat of Paint," W. H. Cantrill; "Modern Industrial Chemistry," R. S. Horsfall.

Among papers read at meetings of the Association in London during the year mention must be made of the following: "Cellulose Nitrate Lacquers" and "Leather Japanning" formed the subjects of two papers read in January by Mr. A. E. Lain and Mr. A. W. Lattey respectively. In February Dr. L. C. Martin dealt with "Colour Measurement," whilst in March Messrs. J. Cruickshank Smith and J. B. Crow described some experiments on "The Flash Point of Paint and Varnish," followed by a description of some "Problems in the Painting of Ships," by Mr. R. G. Browning. Dr. A. P. Laurie discussed "The Optical Properties of Linseed Oil with Particular Reference to the Technique of Van Eyck and his Followers," in an interesting paper delivered in April.

The new session was opened in October by the presidential address on "The Rôle of the Chemist in the Investigation of Problems of Industrial Hygiene." In November Dr. J. J. Fox gave two short papers, one on "Cobalt Blues" and the other dealing with "The Solubility of Paint Pigments."

Three joint meetings with other technical organisations have been held during the year. The first, which took place in March, dealt with "The Grinding of Pigments and Paints," and was a joint discussion with the London Section of the Society of Chemical Industry. In July the Association took part in the "Congress of Chemists" and, together with the Institution of the Rubber Industry, organised a joint discussion on "The Influence of Particle Size in the Paint and Rubber Industries" under the chairmanship of Sir William Bragg. "Painting Defects—their Cause and Cure," was the title of a very practical joint discussion with the Incorporated Institute of British Decorators, held in December.

During 1927 papers will be read dealing with "Cadmium Colours," "Phenolic Resins," "Recent Research on the Protection of Steel with Paint," "The Yellowing of Linseed Oil," and "Some Physical Factors influencing the Properties of Paint Pigments."

The Association was responsible for the section of the "Annual Reports (1925) of the Progress of Applied Chemistry," dealing with paints, pigments, varnishes, and resins. This section was prepared by Messrs. J. Parrish, A. A. Drummond and S. S. Woolf under the editorship of the Hon. Editor of the Journal. These four members are also in charge of the same section of the report for 1926.

In addition to the Journal of the Association, a special monthly supplement of abstracts of current literature has been issued to members at a nominal cost.

The Association has been admitted to the membership of the Federal Council of Pure and Applied Chemistry, and Dr. H. Houlston Morgan has been appointed as its representative on that organisation.

The above brief summary will be some indication that the activities of the Association are continually growing, and that its work plays an increasingly important part in the development of the industries with which it is concerned.

The meetings of the Association are held in the Council Room of the National Federation of Paint and Varnish Manufacturers, Trafalgar Square, and the members usually dine together informally prior to the meetings.

The Institute of Chemistry

The Institute steadily continues the work of professional organisation, the membership having increased at an average rate of nearly 300 per annum during the past few years. When, in 1917, the Institute decided to admit to the Associateship without further examination chemists who had obtained honours degrees or equivalent diplomas and had complied with certain regulations as to training, it was with the object that the Institute should pursue its duty as the organisation which had been duly authorised by Royal Charter to register competent chemists. As a result, the roll of membership now exceeds 5,000; but, even with the provisions made, it was found that the requirements as to academic training barred the admission of certain chemists of undoubted competence who had attained positions of responsibility. The Council has, therefore, during the past year adopted an amendment to the regulations by which it is hoped that these technical difficulties can, to a large extent, be overcome, provided that the candidate is not less than thirty years of age, produces evidence that he has received a training in chemistry, physics and mathematics, and has acquired adequate knowledge of these subjects, that he has been engaged in the study and practice of chemistry for at least twelve years, and is prepared to submit himself to an examination, the nature of which will be determined by the Council in each individual case.

The general standard of qualification has, however, been fully maintained for both the Associateship and Fellowship.

The Council has appointed a Special Committee to consider the whole question of possible further developments in the matter of registration of chemists, and this Committee has prepared a statement which has been submitted to the Local Sections for discussion and concrete suggestions. When reports of the discussions have been received, the Special Committee will continue the consideration of the whole subject.

The Institute has continued to co-operate with the Chemical Society in the provision by that body of a comprehensive chemical library; it has co-operated with the Society of Public Analysts in matters affecting the administration of the Sale of Food and Drugs Acts and the Fertilisers and Feeding Stuffs Act; and with other bodies concerning official chemical appointments. The Institute participated in the arrangements for the Chemists' Congress held in July, especially by arranging an exhibition of laboratory apparatus, instruments, reagents, etc., which was greatly appreciated by the visitors. The Institute also participated in the Annual Chemical Dinner. The Local Sections generally have co-operated with the Local Sections of the Society of Chemical Industry and other bodies.

Among many papers read before the Sections during the year, other than papers on technical subjects which are usually reported in the technical Press, may be mentioned:

Dr. R. B. Forster (Leeds): "The Evolution of the Chemist and his Position in Industry"; Mr. W. J. U. Woolcock (London): "Five Years of Progress in the Fine Chemical Industry"; Messrs. B. D. Porritt, Thos. Macara and R. G. Parker (London): "The Rôle of Chemical Research in Industries Other than the Manufacture of Chemicals"; Prof. H. E. Armstrong (at Manchester) on: "The Nescience of Science and the Conceit of Ignorance"; Dr. W. H. Gibson (at Manchester) on: "The Training and Organisation of Industrial Chemists"; Prof. Henderson, President (at Belfast, Glasgow, and Manchester), on "The Chemist and the Community"; Prof. A. R. Ling (Birmingham) on: "Chemistry as a Career"; Dr. L. L. Lloyd (at Leeds) on: "The Training of a Textile Chemist";

Professor J. S. Thomas (Cape of Good Hope) on: "The Possibilities of Electro-Chemical Industries in South Africa."

In January Mr. G. J. Lemmens read a paper before the Students' Association on "What the Manufacturer expects of the Junior Chemist," and in March, Mr. E. J. MacGillivray, barrister-at-law, gave a lecture before the Institute on "Copyright, with Special Reference to Scientific and Technical Papers and Publications."

At the request of the Finsbury Technical College Old Students' Association, the Institute has undertaken the administration of the Streatfeild Memorial Fund, and will in future make arrangements for the Annual Streatfeild Memorial Lecture. The lecture for 1926 was given by Mr. Francis C. Robinson on "The Chemist in the Non-Ferrous Metallurgical Refinery." Owing to the regretted closing of Finsbury Technical College the Institute has also received the Meldola Library and the Chemical Library of the College, which can no longer be housed at the College.

With the Society of Chemical Industry and the Institute of Metals, the Institute has co-operated in the establishment of a Memorial to the late Sir George Beilby. Subscriptions to a fund raised for this purpose have already been received amounting to over £3,250, and the list is still open. From the income of the fund, at intervals to be determined by the administrators, awards will be made to mark appreciation of records of distinguished work in science, bearing in mind the special interests of Sir George Beilby, viz., applied chemistry, chemical engineering, and metallurgy.

The Council propose to inaugurate a Sir Edward Frankland Prize and Medal for registered students under twenty-two years of age, the award to be made for the best essay not exceeding 3,000 words on a set subject of professional—as distinct from technical or purely chemical—importance.

Although the membership of the Institute has been increasing and, owing to the prevailing industrial depression, it has been difficult to find employment for newly qualified chemists, the number of members who are actually out of employment is decreasing. At the beginning of 1924 there were nearly two hundred members without appointments, but this number had dropped at the beginning of 1926 to about one hundred, and at the present moment shows a still further decrease. These figures suggest that, in spite of the condition of trade, the value of chemical services in industry is more generally appreciated.

The Benevolent Fund Committee has readily answered the appeals received. An annuity fund has been started, the first annuitant having been appointed towards the close of 1925.

The Students' Association has continued its meetings, and, thanks to the kindness of the firms concerned, has been enabled to visit many important works and laboratories.

The scheme of examinations for the award of National Certificates in Chemistry, in conjunction with the Board of Education, continues in active operation, and a similar scheme in conjunction with the Scottish Education Department is in full working order.

British Engineering Standards

The Paint and Varnish Sections of the British Engineering Standards Association have been actively engaged during the last twelve months completing the specifications in hand and preparing others that will be published from time to time as they are completed. The work was divided up between three committees dealing respectively with (*a*) pigments and other raw materials (*b*) ready mixed paints, and (*c*) varnishes, and the following specifications have been published since March of this year:—Genuine dry white lead, genuine white lead oil paste, red lead, refined linseed oil, raw linseed oil, boiled linseed oil, white spirit type I, turpentine type I, zinc oxide, asbestine, barytes, exterior oil varnish, interior oil varnish, and flatting oil varnish.

A large number of specifications are under consideration by the committees; consideration is also being given to the question of the standardisation of colours for ready mixed paints.

The B.S. specification for portland-blast-furnace cement was revised during the year, so as to bring the tests up to the level of the B.S. specification for portland cement, a new edition of which had been issued in 1925. The association has also in hand a specification for building limes.

The Electrical Section of the Association has issued the British Standard Glossary of Terms Used in Electrical Engineering, No. 205, 1926, and in this glossary is a section dealing with electro-chemistry.

The British Standard Specification for Insulating Oils (No. 148) is under revision, amendments being made both in the specification itself and in the methods of testing the oil.

The Faraday Society

The Faraday Society has made good progress during the year. The year has been an active one in regard to the publications of the Society, the Council having adopted for the first time the policy of regular publication. There has appeared this year one part of last year's volume, which comprised in the main the report of the important General Discussion on "Photochemical Reactions in Liquids and Gases," which was held at Oxford in the autumn of 1925. The six bi-monthly parts of the present volume have also appeared, in addition to separate reports of two General Discussions on "Explosive Reactions in Gaseous Media" and "Physical Phenomena at Interfaces, with Special Reference to Molecular Orientation." The new policy is already having its effect upon the circulation of the publications of the Society. It has been possible, for the first time, to arrange an annual subscription for non-members of the Society, an opportunity which has been grasped by some 150 subscribers. The membership of the Society also has increased. Professor F. G. Donnan relinquished the presidency on the completion of two years of office and was succeeded by Professor C. H. Desch.

The Society suffered a severe loss in the early summer by the death of Mr. F. S. Spiers, who had been secretary and editor since its foundation. The world-wide reputation of the Society's publications, and particularly of the reports of the General Discussions, owes much to the many years of devoted work by Mr. Spiers. Mr. G. S. W. Marlow has been appointed to the vacancy thus occurring.

British Association of Chemists

The Association is in every way in a more satisfactory position than at the end of 1925. Evidence of this fact is immediately apparent in the condition of the general fund, which this year shows a balance after accounting for last year's deficit. In other directions the Association's position is greatly improved and its prestige increased.

In the first place the attitude of the executive upon the declaration of the general strike must be explained. Not only did the Association refuse to associate itself with the Trade Union Council, but the services of its members were offered to the Government for the maintenance of the vital services. The executive has thus made it clear—without wishing to express any opinion as to what shall be the policy of other associations or trade unions—that, for itself, it will in no circumstances support or make use of the strike weapon for the settlement of disputes. The "third party principle" has been, and will remain, the policy of the Association in such questions.

At the invitation of the Society of Chemical Industry, the Association took part in the Congress of Chemists held in July, 1926, and was responsible for the organisation of a discussion on "Chemistry House," which took place on Tuesday, July 20.

Considerable advance has been made in the question of registration, though details in connection with this matter scarcely fall within the sphere of this report. The Institute of Chemistry's special committee has issued a report upon which the Association has commented in another place. In any case, the annual general meeting of the Association, held on October 30 in Liverpool, reaffirmed its intention of pressing forward the matter, and it directed the council to set up a special committee to deal with the question. The operation of this committee has been in abeyance in deference to that of the Institute, but it now appears desirable that it should be reformed with as little delay as possible. A large number of most useful proposals have already been put forward unofficially, and these will be of great assistance to the committee in framing proposals.

The Association has been in communication with the Home Office regarding the employment in England of chemists not of British nationality, with most satisfactory results. The Home Office and the Ministry of Labour agreed that alien chemists should not be employed to the detriment of English chemists except in cases where their knowledge was being applied to train English chemists in special circumstances; an assurance was given that the British chemist would be properly protected.

The Engineering and Allied Employers Federation having prepared a benefit scheme which appeared to prejudice professional protective organisations, the Association made a strong protest both in the press and to the Federation itself. Although the Federation could not be induced to modify the rule which included professional associations in the same category with ordinary trade unions, this action effectually prevented victimisation which might otherwise have taken place.

Through a time of unexampled depression, the Unemployment Benefit Fund has again done splendid work. Over £1,000 has been paid out during the last fourteen months, and many unemployed members would have been faced with serious difficulties had it not been for the assistance the fund has been able to render.

It is not an exaggeration to assert that the case of Madden *v.* Holland, a case conducted by means of the Legal Aid Department of the Association, has practically created a precedent. In this case it was ruled that a chemist was entitled to three months' notice in the absence of express agreement to the contrary; and in obtaining this ruling the Association has done a most important service to the whole profession. The department has advised members on matters of service agreements in a large number of cases with the most satisfactory results. H. T. F. R.

Institution of Fuel Technology

Fuel plays a paramount part in the life of our people and it is essential in all productive industry for locomotion, for illumination, and for heating. The great strides being made throughout the world in the direction of scientific investigation of the composition, properties, and commercial values of fuel and its products, together with economical methods of fuel applications, should be common knowledge available for the benefit of all concerned. With this end in view the Institution of Fuel Technology was founded in Great Britain in 1926 at perhaps the psychological moment, under the presidency of Sir Alfred Mond, M.P., chairman of I.C.I. The council of the Institution consists of representatives of pure science, the coal, liquid fuel, gas, electric power, shipbuilding, iron and steel, chemical, and general industries, engineering trades and public health interests, who are all acknowledged leaders in these respective categories of our national life. Among them are Professor H. B. Dixon, F.R.S.; Sir Robert Hadfield, F.R.S.; Dr. D. Milne Watson; Dr. F. A. Freeth, F.R.S.; Dr. Rudolph Lessing; Sir Richard Redmayne; Dr. M. W. Travers, F.R.S.; and Professor R. V. Wheeler.

The broad policy adopted by the council in framing the constitution of the Institution admits of all who may be directly or indirectly interested in subjects connected with any form of fuel becoming members of a society which, through its operations, may very materially influence the future prosperity of industries in Great Britain and the healthful life of her people. To further this end the council of the Institution of Fuel Technology seeks the co-operation of all the leading existing societies by asking them to nominate additional members of council to represent the interests of the older institutions.

The first meeting of the Institution of Fuel Technology was held in London on December 7 and 8, 1926, when the following papers were read and discussed: "Some Phases of Modern Practice in Gas Manufacture," by Mr. T. Hardie; "The Combustion of Solid Fuel," by Professor R. T. Haslam; "The Occurrence, Working, and Treatment of Brown Coals, with Special Reference to German Practice," by Sir Richard Redmayne; "The Hydraulic Theory of the Flow of Gases in Furnaces," by Professor Groum-Grjimailo; "The Carbonisation of Bituminous Coals at Low Temperature," by Mr. S. McEwen, and "Smoke and Public Health," by Dr. J. S. Owens. A full report of the meeting appeared in THE CHEMICAL AGE of December 11, 1926.

Inquiries should be addressed to the secretary of the Institution of Fuel Technology, 202, Abbey House, Westminster, London, S.W.1.

Society of Chemical Industry

Probably the two most noteworthy events in the Society's history during 1926 have been the Congress of Chemists, held in London in July, and the formation of the new Fuel Section of the Society.

The Congress, which was organised by an Executive Committee representing the London Section and the Chemical Engineering Group, was the occasion of the largest gathering ever brought together at an annual meeting of the Society, this being the result of the effective co-operation with the Society of 16 allied societies and associations concerned with the progress of pure and applied chemistry. An outstanding feature of the Congress was the opening meeting in the Mansion House presided over by the Lord Mayor, at which the Messel Lecture was delivered by the Earl of Balfour, who thereafter received the Society's Messel Medal at the hands of the Duke of York.

The Fuel Section has been formed for the purpose of co-operating with the local sections in the organisation of fuel subjects of particular interest to individual local sections, and with outside organisations interested in special branches, such as the Coke Oven Managers' Association, in the arrangement of symposia having technical, scientific, and practical value. This section since its inception has organised a meeting in connection with the Congress of Chemists, has taken part in the Smoke Abatement Conference in Birmingham, and, jointly with the Coke Oven Managers' Association, the Institution of Gas Engineers, the Manchester Section and the Chemical Engineering Group of the Society, carried through the Conference on Tar held in Manchester in November. Membership of this section is open to all members of the Society, the annual registration fee being 5s.

The Society continues to take an active share, through its representatives, in the work of the Bureau of Chemical Abstracts, the Federal Council for Pure and Applied Chemistry, and other bodies such as the National Physical Laboratory, British Engineering Standards Association, Mineral Resources Department of the Imperial Institute, the Imperial College of Science and Technology, the Library of the Chemical Society, and the British National Committee on World Power.

The various sections at home and abroad and the Chemical Engineering Group continue to exhibit much well-directed activity in the interests of the Society by organising conferences as well as by obtaining new members. The continued lack of employment, and in many cases, consequent change of occupation, still continues to affect adversely the desired increase of membership.

The next annual meeting will be held in Edinburgh on July 4–8, 1927, under the presidency of Mr. Francis H. Carr, C.B.E. It is hoped that the preliminary programme will be available early in the New Year.

The Chemical Society

During the year the Society has continued steadily with its work, which, as laid down in its Royal Charter of 1848, is "the general advancement of chemical science by the discussion and publication of new discoveries, and the interchange of valuable information respecting them." The usual fortnightly meetings for the reading and discussion of scientific papers have been held, and the publication of papers in the *Journal* has continued normally. During the year abstracts of papers on pure chemistry have been published, in conjunction with the Society of Chemical Industry, in *British Chemical Abstracts*, and the usual volume of Annual Reports has been issued. During 1925, 96 applications were received for assistance from the Society's research fund, a total of £772 being allocated. The library now contains over 30,000 volumes, and, by arrangement, is open to fellows of a number of other societies: the attendances during 1925 numbered 6,994. The Longstaff medal for 1927 has been awarded to Professor R. Robinson,

and the Harrison Memorial Prize for 1926 to Dr. C. R. Harington. The present officers of the Society are: president, H. B. Baker, C.B.E., D.Sc., F.R.S., treasurer, J. F. Thorpe, C.B.E., D.Sc., F.R.S.; secretaries, T. Slater Price, O.B.E., D.Sc., F.R.S., and C. S. Gibson, O.B.E., M.A.; foreign secretary, F. G. Donnan, C.B.E., F.R.S.; assistant secretary, S. E. Carr, F.C.I.S.; librarian, F. W. Clifford. The Society's rooms are at Burlington House, Piccadilly, London, W.

The Colour Users' Association

The Association has continued its work of consolidating, developing and defending the interests of the dyers. The great developments which have occurred in the dye-making industry, and in the chemical industry generally, both here and abroad, have been carefully watched. At the annual general meeting approving reference was made to the continuous progress achieved by the British Dyestuffs Corporation, and it was urged that the vital importance of fundamental research should be kept in view. During the year a deputation from the Association visited the Continent with a view to investigating the prices of dyestuffs in France, Italy, Belgium, and Germany, and a large amount of valuable statistical information was collected. In regard to this matter it was pointed out by Mr. H. Sutcliffe Smith, in his address as chairman, that it was recognised, not only here, but on the Continent, that in view of the possible extension of amalgamations and conventions of dye makers, it might be desirable at no distant date for users from various countries to meet at regular intervals for the protection of their interests.

The last report issued by the Association indicated that the membership at April 30, 1926, was 178. Among the changes of the council membership may be noted the resignation of Mr. G. V. Clay (of Robert Clay, Ltd., now a branch of the Bradford Dyers' Association), and the death of Mr. Charles Roberts, of the Calico Printers' Association. The balance-sheet shows cash in hand to the amount of £3,232.

Society of Glass Technology

During the year the Society has held eight meetings, three at Sheffield, two in London, and one each at Manchester, Leeds, and Stourbridge, and at these meetings 33 papers have been communicated. Of special interest was the combined May and June meeting in London, when a delegation of members of the Stained Glass Association of America was entertained at the annual dinner. The tenth anniversary of the founding of the Society was celebrated at the November meeting in Sheffield.

During the year arrangements were made for the publication, at first annual, of reports of progress in glass technology, prepared by authorities in various countries of the world. Visits of the society have been paid to six industrial plants. At the annual general meeting, Mr. Walter Butterworth, senr., was elected president for the year 1926–27. The general treasurer is Mr. J. Connolly; the American treasurer Mr. F. C. Flint, Washington, Pennsylvania; and the secretary is Professor W. E. S. Turner, The University, Sheffield.

British Chemical and Dyestuffs Traders' Association

The British Chemical and Dyestuffs Traders' Association, Ltd. have carried on their work of protecting merchant traders' interests, and, with the renewal of the Key Industries legislation, have been particularly active this year. They gave important evidence before the Government Committee that investigated the effect of the past five years' safeguarding. The usual routine work in advising members on the Dyestuffs Act, Merchandise Marks Act, and other measures and matters affecting the trade has been performed. Membership is now very representative of the trade, and the Association has firmly established its position since the amalgamation, which took place in 1923. There are no other trades, so far as merchants are concerned, so hedged round with Government control and restrictions as the chemical and dyestuffs trades, and a strong trade organisation is vital to the trading interests concerned.

British Cyanides Co.'s Losses

Reconstruction Proposals Put Forward

THE accounts of the British Cyanides Co. for the year ended April 30, 1926, show a loss of £23,833, to which must be added the loss on the sale of plant, stores, etc., and on the claim against the British Potash Co., now in liquidation, as also the loss brought forward, bringing up the total loss to £101,083. Further, an account for the six months ended October 31 last shows, subject to audit, a further loss of £12,093, while upon the investment in the Oldbury S.C. Syndicate there will be a loss of £87,523. The directors state that the manufacture of sulphocyanide into ferrocyanide for sale as such has been unprofitable ever since the duty on the latter chemical was raised by the Fordney Tariff in the United States. With a view to the provision of further working capital to enable the company to proceed with the manufacture and sale of a new resin, it is proposed to reduce the issued capital from £393,414 to £62,139 by writing off 10s. of the £1 per share paid up on the preference shares and 18s. of the £1 per share paid up on the ordinary shares. The existing rights of the preference shareholders will be preserved by increasing their dividend from 5 per cent. to 10 per cent. per annum and providing that on a distribution of assets they shall be entitled to preferential payment of £1 for every 10s. paid up. Preference shareholders will also be asked to waive the arrears of dividend down to December 31, 1926, and also to agree that their dividends for the years 1927 and 1928 shall be non-cumulative. It is proposed that the preference shareholders shall have the right for three years from January 1, 1927, to convert their preference shares into ordinary shares. Each reduced 10s. preference share will be subdivided into five 2s. preference shares. Further capital will be provided by offering for subscription to the ordinary shareholders 672,838 further ordinary shares of 2s. each, being at the rate of two for one.

Chemical Merchant's Failure

MR. A. L. FREEMAN, import and export merchant dealing in tallow, chemicals, etc., of 476, Seven Sisters Road, Finsbury Park, London, attended for public examination in the London Bankruptcy Court before Mr. Registrar Warmington recently. The failure occurred in October last, the debtor's gross liabilities being estimated at £21,228, of which £18,728 are unsecured and expected to rank for dividend against net assets valued at £8,179. In or about 1906 the debtor commenced business under the style of "A. Freeman and Company," as an import and export merchant. He had a commencing capital of about £1,000. In July, 1921, in consideration of £10,000 in £1 fully paid shares, he transferred his business to a company then formed, of which he had since acted as managing director at a remuneration of £500 per annum. He attributed his failure and insolvency to the failure of consignees in Italy to take delivery of tallow and chemicals consigned to them early in 1921, and to subsequent litigation in connection therewith. The examination was closed.

Milk Analysis Certificates

A CIRCULAR issued by the Ministry of Health to Sale of Food and Drugs Act authorities in England and Wales directs attention to the Public Health (Milk and Cream) Regulations and their administration. It is pointed out that a few public analysts, in reporting on a sample of milk which is found to be deficient both in milk fat and in other milk solids, word their certificates in such a way as to imply that the double offence of the abstraction of fat and the addition of water has been committed, whatever the relative degrees of the two deficiencies. After consultation with the Society of Public Analysts, the Minister of Health recommends that in such a case the certificate forwarded should be so worded as to show how much, if any, of the deficiency of milk fat is presumed to be due to abstraction, allowance being made for the effect of the added water. A memorandum is enclosed with the circular embodying in a revised form the procedure to be adopted by local authorities and their officers in the administration of the Sale of Food and Drugs Acts.

Steam Power Practice

A Note on Recent Developments

BOTH steam generation and utilisation for power production are now more than ever a specialised branch of chemical engineering, and the most important developments during the past 12 months, as gathered from the recent congress of the American Institution of Electrical Engineers, are reheating of the steam between the stages of the turbines, the use of steam bled from the turbine for feed-water heating, air heating, and the burning of pulverised coal.

With regard to reheating steam in a secondary superheater, this is obviously a highly scientific principle from the thermal point of view, although naturally it is only suitable for very large power plants. Much difference of opinion, however, still continues to exist with regard to the net commercial value of the practice because of the cost and complication of the pipe circuit and other equipment necessary. Heating of the feed-water by means of low pressure "bleeder" steam from the turbine is a matter more for power stations, and in this connection we have now arrived at the four-stage bleeder heating system in the case of high pressure steam of 500 lb. and over.

Some very interesting information was given at the congress concerning the present performance of different types of power station equipped on these lines, and, for example, in one case with four-stage bleeding and air heating, 1 k.w. is being obtained for 13,360 B.Th.U., while in another instance with three-stage bleeding and air heating, together with feed-water economisers, the figure is 13,030 B.Th.U., an amazing performance, most of the power stations of the world being over 22,500 B.Th.U. per lb., while industrial plants are, of course, much worse.

Air heating is now making gigantic strides in the United States. This development arises from the original installation of two experimental "Usco" air heaters installed at the Colfax power station, Pittsburgh, in 1922. These proved to be very successful as shown by the well-known papers given by C. W. E. Clarke before the American Institution of Mechanical Engineers, and air heating is now rapidly becoming standard practice for steam boiler plant of all kinds. Air heating with pulverised coal has also been proved to be a highly efficient proposition, and the heat obtained in the furnace is so intense that modern water cooled walls such as the "Murray-Usco" have been rendered necessary quite apart from the thermal efficiency. Many different modifications are, of course, possible, according to the conditions, and in a large number of cases, for example, the air on its way to the air heater is first passed through hollow firebrick walls if these are situated at the front and back. Economisers are not being used to the same extent for water tube boilers, but the feed-water, at a temperature up to 350° F. because of multi-stage bleeding, is passed direct to the "Murray" or other water cooled walls, consisting of 4 in. vertical tubes under full boiler pressures. As far as the ordinary industrial boiler plant is concerned, as in the average chemical works, air heating has obvious advantages and for "Lancashire" boilers the ideal is superheater, economisers, and air heaters, each designed in heating surface to suit the individual circumstances.

Modern Technical Advertising

AN attractive brochure just issued by the Technical Advertising Service (Mr. J. Bertram Ward, B.Sc., A.I.C., and Mr. W. K. Crampton Chalk) is in quite the best modern publicity style. Its letterpress is direct and snappy, getting the points home with directness—which is exactly what a good advertiser does—while the colour designs mentally arrest attention. The philosophy, or psychology, of advertising is stated in brief but explicit terms, and due emphasis is placed on the supreme importance and the right method of presentation. Important in the general class of advertising, this is doubly important in technical publicity. In this difficult field the T.A.S. appears to have been successful in combining sound methods with the distinctive modern note, and already, it is clear from the testimonials published, the new style is finding favour with good chemical concerns.

A Double Motor-Cycling Fatality

A MOTOR-CYCLING accident, involving the death of two chemists, occurred at King's Heath, Birmingham, on the afternoon of Friday, December 24. The victims were Reginald Hulse, single, aged about 30, of Bristol Road South, Northfield, a metallurgical chemist, employed at the B.S.A. Works, Birmingham, and Albert Baden Holmes, married, aged 26, an analytical chemist, of Hunnable Road, Braintree, Essex, whose parents live at King's Heath. Holmes had gone to spend Christmas with his parents. He was riding pillion with legs astride, and Hulse, who was driving, failed to negotiate a bend in the road. He attempted to steer the motor-cycle into Uffculme Park, the gates of which were open, but the machine overturned and both men were killed almost instantaneously.

I.C.I.: Share Exchanges

WE are informed by Imperial Chemical Industries, Ltd., that reports received from the registered offices of the various participating companies up to date show that the response to the invitation to shareholders to exchange their shares for shares in Imperial Chemical Industries is completely satisfactory, exchanges coming in at a steady rate. A feature of recent Stock Exchange activities has been the commencement of dealings in I.C.I. shares. The ordinary shares stand at 21s. 7½d., the seven per cent. cumulative preference at 23s., and the deferred at 6s. 6d. The preference and ordinary shares are of the nominal value of £1, and the deferred of 10s. Brunner Mond's shares stand at 37s. 6d., Nobel ordinary are at 39s. 3d., Nobel deferred at 19s. 6d., British Dyestuffs at 17s. 6d., and United Alkali at 33s. 9d.

Key Industries Additional Lists

ADDITIONAL lists of articles chargeable with duty under Part I of the Safeguarding of Industries Act, 1921, have been issued by the Board of Trade, and will take effect as from January 15, 1927. These lists refer to articles under the following headings:—Optical glass and optical elements; optical instruments; laboratory porcelain; scientific instruments; synthetic organic chemicals. Copies of the lists may be obtained from His Majesty's Stationery Office, price 2d. net.

Further meetings of the Committee on Tableware of Translucent Pottery will be held on January 3, 4, 5, 18, 19, 24, 25 and 26, in each case at 10.30 a.m., in Quadrangle Court B, Royal Courts of Justice, Strand, London, W.C.2.

£5,000 Fraud Charge

ROBERT BROWNLOW, industrial chemist and engineer, was charged on a warrant at Bow Street Police Court on Thursday, December 23, before Sir Charles Biron, with fraudulently incurring a debt and liability of £5,000 to Emil Otto P. F. Schwarz. The detective officer who gave evidence of arrest stated that the Director of Public Prosecutions would take up the case, which would be a very long one. Mr. Percy Handcock, for the defendant, applied for bail, and mentioned that the £5,000 advanced by Mr. Schwarz had already been the subject of proceedings in the High Court. The magistrate granted a remand for eight days, and said he would consider the question of bail at the next hearing.

Canadian Explosives Plant Reopens

PLANS are under way for reopening the Canadian Explosives Co.'s plant at Nobel, six miles from Parry Sound, Ontario. Immediate employment will be given to 200 men. During the war the Nobel plant was one of the largest producing explosive plants in Canada, but it has since remained closed. The engines or machinery of war can generally be made to serve mankind in peace, and great quantities of explosives are now being demanded in the boom which is taking place in the mining industry of Canada. The Nobel plant will no doubt do much toward uncovering Canada's hidden wealth in precious and economic minerals.

From Week to Week

THE ADDRESS of the Ceramic Society has been changed to North Staffordshire Technical College, Stoke-on-Trent.

THE INTERNATIONAL HOLDINGS AND INVESTMENT CO., LTD., announces that the address of its registered offices is now 15, St. Helen's Place, Bishopsgate, London, E.C.3.

THE UNIVERSITY OF LONDON is to receive from the managing director of Vultex Products, Ltd., on behalf of Mr. Patrick Gow, a sum of money for three years for lectures on colloidal chemistry.

RUSSIAN STEEL TRUST representatives arrived in Essen recently for an official visit to the Ruhr steel industries. Their purpose is to negotiate with the German industrialists for the construction of foundries, cokeries, and ore refining plants in South Russia.

THE STAVELEY COAL AND IRON CO. are making further preparations for restarting their works. Another enormous gas engine is to be erected, making the second of a batch of three which will use waste gas from the coke ovens and generate electricity for the ironworks and miners' houses.

DR. EDWARD R. WEIDLEIN, Director of the Mellon Institute of Industrial Research, University of Pittsburgh, was elected president of the American Institute of Chemical Engineers for the year 1927 at the recent annual meeting of the organisation in Birmingham, Alabama. Dr. Weidlein has been a member of the A.I.C.E. council since 1924.

VINCENT HAIGH (14) claimed compensation at the Huddersfield County Court, on Wednesday, December 22, from the Huddersfield Dyers, Upperhead Mills, for injuries to his right hand while he was working at a machine in the mills. The judge said that he would like to see the machine working, and the case was adjourned till January 26.

AN ACCIDENT, fortunately not attended by injury to the operatives, occurred at the Sheffield works of Thos. Firth and Sons, Ltd., on Wednesday, December 22. The bottom of an electric furnace gave way, and 10 tons of steel which had just been melted dropped out into a pit underneath, where it exploded. Five men who were working at the furnace had very narrow escapes.

APPLICATIONS ARE INVITED for the following appointments:—Lecturers in Organic Chemistry, Bio-Chemistry and Physical Chemistry in the Indian Institute of Science, Bangalore. Rs.400-25-500 per month, plus house allowance. The Director. January 31.—Adviser in Agricultural Chemistry in the University of Manchester, £400. The Registrar. January 20.

ON OCTOBER 13 Mr. W. S. Jarratt, Comptroller-General of Patents, heard the opposition of the International Electrolytic Plant Co., Ltd., to the application of De Nordiske Fabriker De-No-Fa Aktieselskap and Dr. Eng Carl Fredrik Holmboe for Letters Patent No. 229,624 for improvements in electrolytic apparatus. On December 10 the decision was given that in face of the opposition the grant of Letters Patent on the application was refused.

RECENT WILLS INCLUDE:—Mr. Stuart Moore Roehead, of Manchester, Turkey red dyer, £6,939.—Mr. N. E. Parsons, of Bray, Berkshire, of Ashton and Parsons, Ltd., manufacturing chemists, £61,034.—Mr. Thomas Killey, of St. Helens, a director of the United Glass Bottle Manufacturers, £30,085.—Mr. Albert Cartwright Wood, late of Wood's Bottle Works, Baileyfield, Portobello, Edinburgh, £4,190.—Mr. Andrew Peters, of Hove, late of Parkyn and Peters, London and St. Austell, China Clay Producers, £11,625.

DR. KING, OF THE FUEL RESEARCH STATION, will read a paper on "The Production of Liquid Fuels from Coal" at a meeting of the Nottingham Section of the Society of Chemical Industry, at University College, Nottingham, on January 12. The present position of the country, so far as the availability of oil fuel is concerned, will be discussed. The methods now before the scientific public will be discussed and results quoted under the headings of low temperature carbonisation; the hydrogenation of coal by the Bergius process; and the reduction of carbon monoxide for the catalytic production of liquid fuels. Under the first two headings the work of the Fuel Research Station will be particularly described.

AT THE MEETING of the Society of Glass Technology held at University College, London, on Wednesday, December 15, the following papers were read: "Further Note on Sillimanite as a Glass Works Refractory," by Professor W. E. S. Turner; "Some Corrosion and Erosion Phenomena and Their Bearing on the Microstructure of Refractories," by J. F. Hyslop, R. Gumm, and H. Biggs; "A Note on the X-Ray Patterns of Mullite and Sillimanite," by J. F. Hyslop and H. P. Rooksby; "Note on the Design of Parison Moulds," by Dr. S. English; "The Viscous Properties of Glass," by V. H. Stott. Owing to lack of time, the reading of a paper by Professor Turner on "The Effect of Cullet on the Melting of Glass" was postponed.

THE EARL of LEVEN AND MELVILLE has been appointed a director of Borax Consolidated, Ltd., and has accepted the position of chairman.

MR. S. R. CARTER has had conferred upon him the D.Sc. degree of the University of Birmingham, for numerous published papers on the oxidising properties of sulphur dioxide and other subjects.

MR. J. A. REAVELL, of the Kestner Evaporator and Engineering Co., is sailing for Bombay on the *Rajputana* on January 14 from Marseilles, and expects to be away for about three months on the business of the firm.

THE FOLLOWING SCHOLARSHIPS have been awarded by the Senate of the University of Glasgow: the Strang Steef Research Scholarship in Chemistry (£160) to Mr. W. C. Lyle, B.Sc.; the Mackay Smith Scholarship in Chemistry (£48) to Mr. R. F. Drummond, B.Sc.

ROBERT GORDON'S COLLEGES are to be rebuilt, and part of the rebuilding scheme is to be carried out at once at an estimated cost of £37,200. The rebuilding will involve the chemical and pharmaceutical departments of the technical college. The latter have been recognised by the Pharmaceutical Society and the University of London.

SCOTTISH DYES, LTD., presented a handsome shield for competition amongst works ambulance teams in Grangemouth, which was competed for last week, six teams taking part. The winning team was Dyeworks No. 1 team with 261 marks, Dyeworks No. 3 team being second with 260, and L.M.S. Railway team No. 2 third with 237 marks.

LANGSTON-JONES AND SAMUEL SMITH, LTD., of Weston Street, Bow Common, London, state that following the recent fire at their premises all orders will be executed without delay, and that work will be found for the staff. The fire was confined to the oil and grease department. The separate building containing the stocks of varnish and the plant is intact.

J. M. STEEL AND CO., LTD., 7 and 8, Poultry, London, E.C.2, announce that they are moving to new offices, and that from December 29 their address will be Kern House, 36-38, Kingsway, London, W.C.2. The new telephone numbers will be Holborn 2532 (three lines). The inland telegraphic address will be "Coaltar, Westcent, London," and for foreign cables "Coaltar, London."

AT PONTEFRACT COUNTY COURT on December 23, George Wigham, of Ackworth Moor Top, claimed from the Limmer and Trinidad Asphalt Co., Ltd., £500 compensation for the loss of his son, aged 16½, who was injured whilst oiling a "mixer" in their service at Carcroft on August 20, and died the same day. His Honour Judge McCarthy assessed the parents' loss at £250, and gave judgment for that sum.

THE UNITED STEEL CO. are restarting to satisfy the demand for immediate delivery of ordinary and special qualities of hematite pig iron. Two furnaces were relighted on Wednesday at Workington, and two others will be relighted as soon as local coke supplies become available. Six furnaces will be in blast in Cumberland during the week end. Two blast furnaces were blown in by the Millom and Askam Hematite Iron Co. last Monday, and the steel works at Workington are expected to resume in the middle of January.

The Mining Laws of the Orange Free State is the title of a volume which will shortly be published by H.M. Stationery Office (pp. 196, 7s. 6d.), being a part of the series on "The Mining Laws of the British Empire and Foreign Countries" commenced by the late Imperial Mineral Resources Bureau and now carried on by the Imperial Institute. This work consists of an ordered analysis of the laws and regulations relating to mining in the Orange Free State. All the relevant cases are referred to and the texts of the various acts, ordinances and regulations relating to mining as amended from time to time are printed in *extenso*. The work is fully indexed, and should be of considerable value to those persons associated with mining in the Orange Free State and to the lawyers who have work in connection therewith.

Obituary

MR. WILLIAM BEAMONT HART, F.I.C., F.C.S., of Oakhurst, Urmston.

DR. K. HELL, emeritus professor of general chemistry in the Stuttgart Technical High School, on December 11, aged 77. He published numerous papers on organic chemistry.

MR. LAURENCE PULLAR, a distinguished native of Perth, on Wednesday, December 22, in his 84th year. Mr. Pullar was the fourth son of the late Lord Provost Pullar, Perth, and was head of the well-known firm of Robert Pullar and Sons, Bridge of Allan, a business quite apart from that so long known in Perth as J. Pullar and Sons, dyers and cleaners, although the two businesses had a close family association. He was a fellow of many learned societies and gave liberally to research work, his most recent public benefaction in this direction being £25,000 to Edinburgh University. Two of his brothers, who died several years ago, were Sir Robert Pullar and Mr. James Pullar, founders of the dyeing industry in Perth.

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CYANIDES.—The preparation of molten alkali cyanide from crude cyanide and potassium ferrocyanide. Part II. F. Muhlert. *Chem. Apparatur*, December 10, 1926, pp. 269–271.

ELECTRO-CHEMISTRY.—On the electrochemistry of beryllium. S. Bodforss. *Z. physikal. Chem.*, October 28, 1926, pp. 66–82.

GENERAL.—The influence of ring substituents on the stability and reactivity of aromatic compounds. K. v. Auwers and P. Bullmann. *Ber.*, December 8, 1926, pp. 2719–2737.

The combination of potassium with carbon. K. Fredenhagen and G. Cadenbach. *Z. anorg. u. allg. Chem.*, December 10, 1926, pp. 249–263.

Formation of gold from mercury. A. Miethe and H. Stammreich. *Z. anorg. u. allg. Chem.*, December 10, 1926, pp. 185–243.

HYDROGEN.—New method for the production of hydrogen. J. Bronn. *Chem.-Zeit.*, December 8, 1926, pp. 922–923.

REACTIONS.—Decomposition of bauxite by soda lye without pressure. B. Neumann and O. Reinsch. *Z. angew. Chem.*, December 16, 1926. pp. 1542–1545.

The condensation of pyroracemic acid with paraformaldehyde in presence of sulphuric acid. W. W. Feofilaktow. *Ber.*, December 8, 1926, pp. 2765–2777.

VISCOSE.—Viscose artificial silk manufacture. Part XI. E. Wurtz. *Chem. Apparatur*, December 10, 1926, pp. 271–272.

Patent Literature

The following information is prepared from published Patent Specifications and from the Illustrated Official Journal (Patents) by permission of the Controller to H.M. Stationery Office. Printed copies of full Patent Specifications accepted may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Abstracts of Complete Specifications

261,850-1.—SEPARATING SOLIDS FROM LIQUIDS. Woodall-Duckham (1920), Ltd., and R. Krall, 52, Grosvenor Gardens, London, S.W.1. Application date, August 28, 1925.

261,850. The material is charged into a stationary hopper *a* and is distributed by a rotating plate *b* against the conical rotating plate *c* constructed in steps. The material then passes

Fig.1.

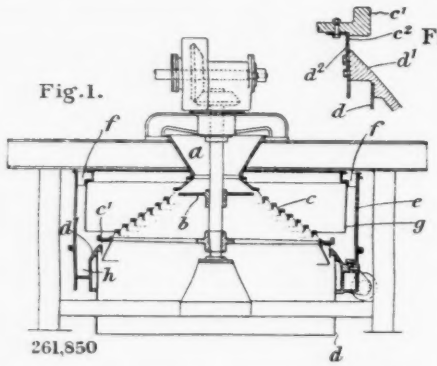


Fig.3.

into the hopper *d*. The separated water is received on the hood *g*, and falls into a trough *h*. The casing *e* is open to the atmosphere at *f*.

261,851. The joint between the bottom ring c^1 of the screen and the ring d^1 which carries the hopper *d*, is shown in Fig. 3. The ring c^1 carries a depending ring c^2, and the ring d^1 carries an upstanding ring d^2 of the same diameter. The clearance between these two rings is so small that any caked dust in it does not prevent restarting of the machine.

261,888 and 262,030. ISODIBENZANTHRONES, PRODUCTION OF. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Application date, October 9, 1925.

261,888. It is known that isodibenzanthrones are produced by condensing halogenated benzanthrones which are Bz1-halogen-benzanthrones by means of a caustic alkali melt or an alkali metal alcoholate. It is now found that Bz1-halogen-benzanthrones containing a free 2-position can be converted into isodibenzanthrones at low temperatures and with good yields by employing a mixture of caustic alkali and alkali metal alcoholate as condensing agent in the presence of inert diluents. The caustic alkali is mixed with a restricted quantity of an alcohol in the presence of an inert diluent and the halogen-benzanthrone; or the alcohol may be replaced by compounds such as benzaldehyde, which by the action of caustic alkali forms benzoic acid and benzyl alcohol. In an example, isopropyl alcohol is added to a mixture of benzene, caustic potash, and Bz1-chlor-benzanthrone at a temperature of 10°–15° C. The mixture is then steam-distilled to remove benzene and alcohol, and boiled with water and hydrosulphite. The dyestuff is precipitated by a current of air.

262,030. In this method for the production of isodibenzanthrones, the condensing agent employed is a metal arylide. In an example, chlorbenzanthrone is added to a solution of sodium anilide obtained by adding metallic sodium to anhydrous aniline. The red-brown colour changes to crimson, and when the formation of the dyestuff is complete the mixture is poured into dilute acid and the dyestuff is filtered off. Other examples are given of the use of calcium anilide and magnesium anilide as condensing agents, and also the treatment of 6.Bz1-dichlorbenzanthrone, 8.Bz1-dichlorbenzanthrone, etc. The products dye vegetable fibres violet-red or violet-blue shades.

261,990. CARBON DISULPHIDE, PROCESS AND APPARATUS FOR THE MANUFACTURE OF. A. J. Stephens, London. From Zahn and Co., Bau Chemischer Fabriken G.m.b.H., 8, Darmstadterstrasse, Berlin, W.15. Application date, May 12, 1926.

This apparatus is for the continuous manufacture and purification of carbon disulphide. Fig. 1 shows an apparatus for purifying sulphur. The crude sulphur is fed into the chamber 2 so that it rests on a grating 3, and on melting runs into the lower part of the apparatus. A partition 4 projects downwards into the molten sulphur so that the lighter impurities are held back, while heavier impurities sink to the bottom. Purified sulphur is drawn off at the outlet 5. The melting device is duplicated as shown, so that either side can be cleaned out at 6, while the other side remains in use. The molten sulphur passes to a vertical retort filled with wood charcoal, in which carbon disulphide is formed.

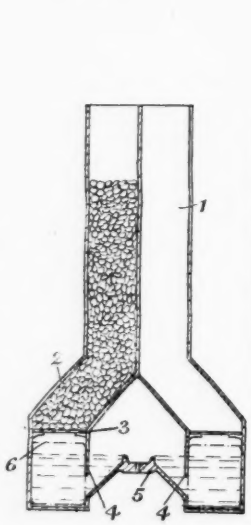


Fig.1.

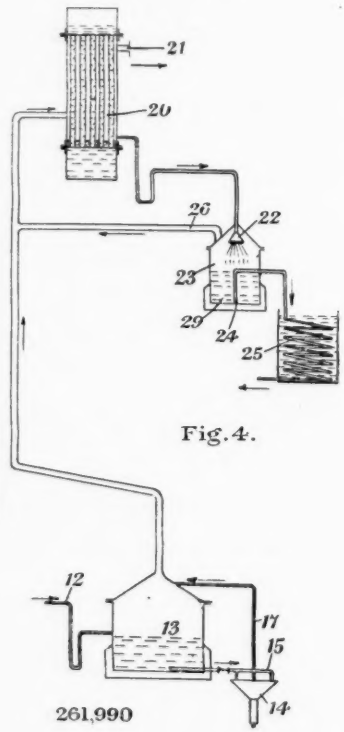


Fig.4.

Fig. 4 shows the purifying apparatus. The crude carbon disulphide passes through a siphon 12 to a still 13 where the liquid gradually becomes richer in sulphur. This liquid is then finally drawn off to a separator 14 comprising an annular funnel-shaped container strongly heated. Sulphur is separated and drawn off by a siphon at the bottom, and returned to the retort, while the carbon disulphide vapour passes through pipe 17 back to the still 13. The carbon disulphide vapour passes to the cooler 20 in which it is condensed, while the hydrogen sulphide liberated passes off at 21 to a Claus furnace. The liquefied carbon disulphide still contains some hydrogen sulphide, and passes through a sprayer 22 to a separator 23 containing pure boiling carbon disulphide. The remaining hydrogen sulphide is thereby liberated and, together with some carbon disulphide, passes through a pipe 26 to the cooler 20. The purified carbon disulphide is drawn off through an overflow pipe 24 to a cooler 25. This process requires only a small still and a small separator 23.

262,017. FERTILISERS CONTAINING SULPHUR AND PHOSPHATE, PROCESS FOR THE PREPARATION OF. B. Bodrero, 15, Rue du Louvre, Paris. Application date, July 26, 1926.

Sulphur containing ores or waste material obtained from the purification of gas are heated to obtain sulphur vapour which is condensed in a vessel containing finely powdered phosphate. The product is a homogeneous phosphate and sulphur fertiliser.

NOTE.—Abstracts of the following specifications which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention :—242,623 (International Combustion Engineering Corporation), relating to carbonising or gasifying fuel; 250,897 (A. and H. Knoll, M. Daege, W. Clemm and K. F. Schmidt), relating to production of amines, substitution products, nitriles, and tetrazoles, see Vol. XV, p. 13.

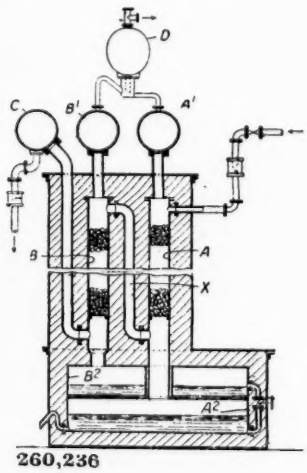
International Specifications not yet Accepted

260,225. PHOSPHORIC ACID. I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. (Assignees of Chemische Fabrik Griesheim-Elektron, 31, Gutleutstrasse, Frankfort-on-Main, Germany.) International Convention date, October 22, 1925.

Liquid phosphorus is fed by gravity or a pump to an ordinary liquid fuel burner, and burned to form the oxide.

260,236. PURIFYING CARBON BISULPHIDE. I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. (Assignees of Chemische Fabrik Griesheim-Elektron, 31, Gutleutstrasse, Frankfort-on-Main, Germany.) International Convention date, October 24, 1925.

Crude carbon disulphide is fed into the top of a column A, and the residual liquid passes into a still A^2. Vapour



260,236

passes through pipe X to the top of a column B. Residual liquid containing sulphur passes into an annular still B^2 above the still A^2, and pure carbon bisulphide vapour passes to a condenser C. The liberated sulphuretted hydrogen passes through reflux condensers A^1, B^1, to a final condenser D, the condensate then passing to the column A. The residue from the still B^2 passes into the still A^2, from which liquid sulphur is drawn off.

260,253. UREA-FORMALDEHYDE CONDENSATION PRODUCTS. I. G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, October 21, 1925.

Urea and formaldehyde are dissolved or suspended in organic solvents, which may be different, and which must contain no water, such as ethylene chlorhydrin, ethylene glycol mono-alkyl ethers, ethylene glycol monoacetate, etc. A condensing agent may be present. Resins, cellulose esters, fillers, etc., may be added.

260,288. UREA-ALDEHYDE CONDENSATION PRODUCTS. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, October 22, 1925.

Urea or a derivative is combined with acrolein or a derivative, with or without a catalyst and solvent, to obtain products which are viscous liquids, gelatinous or vitreous solids. The catalyst may be sulphuric acid, acetic acid, caustic soda, ethylene diamine, etc., and the solvent may be water, methyl or ethyl alcohol, or glycerine. Formaldehyde or other aldehyde may replace part of the acrolein. The products can be used as adhesives, varnishes, or for moulding into various articles.

260,303. DYES. Durand and Huguenin Soc. Anon., Basle, Switzerland. International Convention date, October 26, 1925. Addition to 186,057. (See THE CHEMICAL AGE, Vol. VII, p. 716.)

The ester-like derivatives of leuco vat dyes described in Specification 186,057 are produced by using pyrosulphuryl chloride $Cl.SO_2.O.SO_2.Cl$. in place of chlorsulphonic acid. Thus, leuco dibromindigo may be treated with pyrosulphuryl chloride in presence of dimethyl-aniline and chlorobenzene, the product steam-distilled with sodium carbonate, and the sodium salt of the ester salted out.

260,305. ACETALDEHYDE. Consortium für Elektrochemische Industrie Ges., 20, Zielstattstrasse, Munich, Germany. International Convention date, October 26, 1925.

Acetaldehyde is obtained by the reaction between acetylene and water in presence of a mercury compound and a solvent for acetylene such as an organic compound containing hydroxyl or carbonyl groups, *e.g.*, mono- and poly-hydric alcohols, phenols, carboxylic acids, and ketones. Acetal or an ester may also be used. The vapours are fractionally condensed to obtain the acetaldehyde, the condensed alcohol being returned. In an example, acetylene is continuously circulated through a vessel containing an emulsion of mercury sulphate in water, and ethyl alcohol and further quantities of the emulsion may be added periodically. The excess of acetylene, freed from acetaldehyde, is returned to the reaction and any mercury separated is also removed and regenerated.

260,544. ANTHRAQUINONE DERIVATIVES. Newport Co., Carrollville, Wis., U.S.A. (Assignees of I. Gubelmann, 1202, Fairview Avenue, South Milwaukee, Wis., U.S.A.) International Convention date, November 2, 1925.

3 : 4-dichlorphenol is condensed with phthalic anhydride in the presence of concentrated or fuming sulphuric acid and boric acid. 2-hydroxy-4 : 5-dichlor-*o*-benzoylbenzoic acid is first formed, ring closure to the anthraquinone derivative taking place at 200° C. The final product is 1 : 4-dihydroxy-2- (or 3-) chloranthraquinone.

260,550. POLYMERISED VINYL CHLORIDE. L. A. Van Dyk, 20, East 12th Street, New York. (Assignee of I. Ostromislensky, 435, Convent Avenue, New York.) International Convention date, November 2, 1925.

The polymerisation is effected in two stages, the first product being soluble in acetone. This is further polymerised by prolonged action of light and/or heat. In the first stage a catalyst such as a soluble lead salt may be added, and the vinyl chloride may be dissolved in an organic solvent. An example is given in which the polymerisation is effected by ultra-violet light, the product being formed into films with the aid of plastifiers such as dichlorbenzene, α-chlornaphthalene, naphthalene, diphenylmethane, acetophenone, *o*-chlorphenol, dichloracetone, benzyl chloride, methyl-ethyl-ketone, xylene, ethyl acetate, ethyl benzoate, trichlorethylene, glycoldiacetate and anisole.

260,552. ALKALI SULPHITES, SODIUM SULPHIDE, SULPHITE AND BISULPHITE. West Virginia Pulp and Paper Co., 200, 5th Avenue, New York. (Assignees of V. Drewsen, Larchmont, N.Y., U.S.A.) International Convention date, October 29, 1925.

Spent monosulphite liquors or neutralised spent bisulphite liquors are concentrated and burned in a reducing flame. The residue of fused sodium sulphide is run into water to form a hot solution, which is mixed at 140° C. with anhydrous

sodium sulphite. An air current is passed through the mixing machine, and the resulting sodium sulphite is continuously withdrawn. The crude sulphite is dissolved, filtered, and concentrated, or may be treated with sulphur dioxide to obtain the bisulphite.

260,567. Active Carbon. Verein für Chemische Industrie Akt.-Ges., 62, Moselstrasse, Frankfort-on-Main, Germany. (Assignees of E. Küchler, 164, Mainzerlandstrasse, Frankfort-on-Main, Germany.) International Convention date, October 27, 1925. Addition to 259,616.

Carbon is activated or reactivated by heating and treating with oxygen which is supplied by diffusion through the walls of the container. The oxygen may be supplied by ensuring an excess in the combustion gases for heating. Carbon dust may previously be agglomerated by means of wood tar and then calcined before activation.

260,568. Perylene Derivatives. G. U. F. Bensa, 25, Piazza Fontane Marose, Genoa, Italy. (Assignee of K. Stieger, Graz, Austria.) International Convention date, October 28, 1925.

A suspension of perylene or its derivatives in glacial acetic acid is treated with the necessary amount of nascent nitric acid at 100° C. This may be done by adding potassium nitrate and then concentrated sulphuric acid in glacial acetic acid. Dinitroperylene separates out on cooling.

260,577. Pyrazolones. C. Mannich, 3, Marienstrasse, Frankfort-on-Main, Germany. International Convention date, October 27, 1925.

The reaction products of esters of β-ketopentamethylene-carboxylic acid and aromatic hydrazines are treated with condensing agents to obtain pyrazolones. Thus, 1-phenyl-3 : 4-trimethylene-pyrazolone is obtained by heating the phenylhydrazone of β-ketopentamethylene-carboxylic acid with dry sodium ethylate in an atmosphere of hydrogen. In a similar manner, 1-*p*-bromphenyl-3 : 4-trimethylene-pyrazolone and 1-*p*-tolyl-3 : 4-trimethylene-pyrazolone are obtained.

260,588. Dyes. I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, October 29, 1925.

Anthraquinone acridone dyes are obtained by heating a 1-chloranthraquinone-2-carboxylic acid with an arylamine in an inert organic solvent, in presence of a condensing agent such as borax, boric acid, potassium bisulphate, arsenious acid, antimonious acid, phthalic acid, or benzoic acid. Some examples are given.

Latest Notifications.

262,738. Process for elaborating the products arising during the liquefaction of carbon by hydration. Deutschen Bergin-Akt.-Ges. fur Kohle-und Erdolchemie. December 11, 1925.

262,774. Manufacture of new dyestuffs. Soc. of Chemical Industry in Basle. December 8, 1925.

262,802. Manufacture of cyanides. Naamlooze Vennootschap Nederlandsche Mijnbouw en Handelmaatschappij. December 10, 1925.

262,818. Manufacture and production of artificial masses, lacquers, and the like. I. G. Farbenindustrie Akt.-Ges. December 14, 1925.

262,819. Manufacture and production of vat dyestuffs of the dibenzanthrone series. I. G. Farbenindustrie Akt.-Ges. December 14, 1925.

262,830. Dyeing cellulose acetate silk. I. G. Farbenindustrie Akt.-Ges. December 14, 1925.

Specifications Accepted with Date of Application

238,566. Rectification of acetic acid. Soc. des Etablissements Barbet. August 14, 1924.

239,884. Ovens for distilling coal and the like. J. Daniels. September 13, 1924.

249,465. Plumbiferous chloride liquors, Process for purifying. Consortium für Nassmetallurgie. March 30, 1925. Addition to 240,401.

251,932. Arsenic and tin, Separation and recovery of. Vulcan Detinning Co. May 6, 1925.

252,693. Aluminium oxide, Production of. Höganas Billesholms Aktiebolag. May 27, 1925.

253,875. Zinc oxide. New Jersey Zinc Co. June 18, 1925.

256,643. Waste gases, Process for the purification of. F. Krupp, Grusonwerk Akt.-Ges. August 7, 1925.

262,492. Separation of minerals by floth flotation. L. A. Wood and Minerals Separation, Ltd. (C. P. Lewis (in part).) August 12, 1925.

262,537. Fast dyeings on the fibre, Process for producing. A. G. Bloxam. (*Akt.-Ges. für Anilin Fabrikation.*) September 17, 1925.

262,546. Electrochemical processes and apparatus for the extraction of copper and zinc from ores. H. S. Mackay. September 24, 1925.

262,552. Metallurgical treatment of copper silicate ores or products. W. Dewar. October 6, 1925.

262,832. Acetic acid, Manufacture of. H. Dreyfus. June 13, 1925.

262,494. Methyl alcohol, Manufacture of. H. Dreyfus. June 13, 1925.

262,364. Keten, Production of. H. Dreyfus. June 13, 1925.

Applications for Patents

Baddiley, J., and British Dyestuffs Corporation, Ltd. Disazo dyes, etc. 31,568. December 13.

Binz, A., and Räth, C. Production of 2-oxy-3-bromo-5-pyridinearsinic acid. 31,612. December 13. (Germany, December 21, 1925.)

British Dyestuffs Corporation, Ltd., and Renshaw, A. Manufacture of sizing materials, etc. 31,739. December 14.

British Dyestuffs Corporation, Ltd., Lodge, F., Shepherdson, A., and Tatum, W. W. Manufacture of anthraquinone derivatives. 31,567. December 13.

Callsen, J., and Farbenfabriken vorm F. Bayer and Co. Manufacture of halogenated alcohols. 31,564. December 13.

Canadian Electro Products Co., Ltd. Manufacture of hydroxy acid esters. 32,057. December 18. (United States, January 11.)

Carpmael, W., and I. G. Farbenindustrie Akt.-Gas. Manufacture of aralkylated unsaturated fats. 31,563. December 13th.

Carpmael, W., and I. G. Farbenindustrie Akt.-Gas. Manufacture of triazo dyestuffs. 31,938. December 16.

Carpmael, W., and I. G. Farbenindustrie Akt.-Ges. Degreasing raw wool, etc. 31,920. December 16.

Chemical Works, formerly Sandoz. Production of 2-amido-4-nitrophenoxyethanol, etc. 32,106. December 18. (Germany, December 19, 1925.)

Chemical Works, formerly Sandoz. Production of dyestuffs. 32,107. December 18. (Germany, December 19, 1925.)

Donald, W. Distillation of coal, etc. 31,641. December 14.

Donald, W. Low-temperature carbonisation of coal, etc. 31,863. December 16.

Dreyfus, H. Treatment of material containing cellulose derivatives. 31,706. 31,707. 31,708. December 14.

Harris, J. E. G., Scottish Dyes, Ltd., and Wylam, B. Dyes, etc. 32,037. 32,038. December 17.

I. G. Farbenindustrie Akt.-Ges., and Mond, A. L. Process for increasing weight of pulverulent heaped material. 31,536. December 13.

I. G. Farbenindustrie Akt.-Ges. Manufacture of trisazo dyestuffs. 31,938. December 16.

I. G. Farbenindustrie Akt.-Ges. Manufacture of bodies of photographic desensitising action. 31,549. December 13. (Germany, December 11, 1925.)

I. G. Farbenindustrie Akt.-Ges. Production of films, lacquers, etc. 31,557. December 13. (Germany, December 14, 1925.)

I. G. Farbenindustrie Akt.-Ges. Production of vat dyestuffs. 31,558. December 13. (Germany, December 14, 1925.)

I. G. Farbenindustrie Akt.-Ges. Dyeing cellulose-acetate silk. 31,765. December 14. (Germany, December 14, 1925.)

I. G. Farbenindustrie Akt.-Ges. Manufacture of cellulose esters. 31,737. December 14. (Germany, March 24.)

I. G. Farbenindustrie Akt.-Ges. Manufacture of polycyclic compounds containing oxygen. 31,812. December 15. (Germany, December 15, 1925.)

I. G. Farbenindustrie Akt.-Ges. Manufacture of azo-dyestuffs. 31,813. December 15. (Germany, December 15, 1925.)

I. G. Farbenindustrie Akt.-Ges. Manufacture, etc., of oil lacquers, etc. 31,948. December 17. (Germany, December 17, 1925.)

I. G. Farbenindustrie Akt.-Ges. Condensation products of anthraquinone series. 31,978. December 17. (Germany, December 17, 1925.)

I. G. Farbenindustrie Akt.-Ges. Manufacture of thiomorpholines of the anthraquinone series. 31,997. December 17, 1925.

I. G. Farbenindustrie Akt.-Ges. Production of oil lacquers, etc. 32,007. December 17. (Germany, December 17, 1925.)

Naef et Cie, M. Preparation of monocyclic ketones, etc. 31,732. December 14. (Switzerland, December 15, 1925.)

Petersen, H. Manufacture of sulphuric acid. 31,880. December 16. (Germany, October 12.)

Petersen, H. Manufacture of sulphuric acid. 31,881. December 16.

Raschig, F. Recovery of phenol from waste water. 31,837. December 15.

United Water Softeners, Ltd. Apparatus for carrying out reactions. 31,793. December 15.

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at makers' works.

General Heavy Chemicals

ACID ACETIC, 40% TECH.—£19 per ton.

ACID BORIC, COMMERCIAL.—Crystal, £34 per ton; powder, £36 per ton.

ACID HYDROCHLORIC.—3s. 9d. to 6s. per carboy d/d, according to purity, strength, and locality.

ACID NITRIC, 80° Tw.—£21 10s. to £27 per ton, makers' works, according to district and quality.

ACID SULPHURIC.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.

AMMONIA ALKALI.—£6 15s. per ton f.o.r. Special terms for contracts.

BISULPHITE OF LIME.—£7 10s. per ton, packages extra, returnable.

BLEACHING POWDER.—Spot, £9 10s. per ton d/d; Contract, £8 10s. per ton d/d, 4-ton lots.

BORAX, COMMERCIAL.—Crystals, £19 10s. to £20 per ton; granulated, £19 per ton; powder, £21 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)

CALCIUM CHLORIDE (SOLID).—£5 12s. 6d. to £5 17s. 6d. per ton d/d carr. paid.

COPPER SULPHATE.—£25 to £25 10s. per ton.

METHYLATED SPIRIT 61 O.P.—Industrial, 2s. 5d. to 2s. 10d. per gall.; pyridinised industrial, 2s. 7d. to 3s. per gall.; mineralised, 3s. 6d. to 3s. 10d. per gall.; 64 O.P., 1d. extra in all cases; prices according to quantity.

NICKEL SULPHATE.—£38 per ton d/d.

NICKEL AMMONIA SULPHATE.—£38 per ton d/d.

POTASH CAUSTIC.—£30 to £33 per ton.

POTASSIUM BICHROMATE.—4½d. per lb.

POTASSIUM CHLORATE.—3¾d. per lb., ex wharf, London, in cwt. kegs.

SALAMMONIAC.—£45 to £50 per ton d/d. Chloride of ammonia, £37 to £45 per ton, carr. paid.

SALT CAKE.—£3 15s. to £4 per ton d/d. In bulk.

SODA CAUSTIC, SOLID.—Spot lots delivered, £15 2s. 6d. to £18 per ton, according to strength; 20s. less for contracts.

SODA CRYSTALS.—£5 to £5 5s. per ton ex railway depots or ports.

SODIUM ACETATE 97/98%.—£21 per ton.

SODIUM BICARBONATE.—£10 10s. per ton, carr. paid.

SODIUM BICHROMATE.—3½d. per lb.

SODIUM BISULPHITE POWDER, 60/62%.—£17 per ton for home market, 1-cwt. iron drums included.

SODIUM CHLORATE.—2¾d. per lb.

SODIUM NITRITE, 100% BASIS.—£27 per ton d/d.

SODIUM PHOSPHATE.—£14 per ton, f.o.r. London, casks free.

SODIUM SULPHATE (GLAUBER SALTS).—£3 12s. 6d. per ton.

SODIUM SULPHIDE CONC. SOLID, 60/65.—£13 5s. per ton d/d. Contract, £13. Carr. paid.

SODIUM SULPHIDE CRYSTALS.—Spot, £8 12s. 6d. per ton d/d. Contract, £8 10s. Carr. paid.

SODIUM SULPHITE, PEA CRYSTALS.—£14 per ton f.o.r. London, 1-cwt. kegs included.

Coal Tar Products

ACID CARBOLIC CRYSTALS.—About 6¾d. per lb. Crude 60's, 1s. 9½d. to 1s. 10½d. per gall.

ACID CRESYLIC 99/100.—2s. 3d. per gall. Steady. 97/99.—2s. to 2s. 1d. per gall. Pale, 95%, 1s. 10d. to 2s. per gall. Dark, 1s. 9d. to 1s. 10d. per gall.

ANTHRACENE.—A quality, 2½d. to 3d. per unit. 40%, 3d. per unit.

ANTHRACENE OIL, STRAINED.—8d. to 8½d. per gall. Unstrained, 7½d. to 8d. per gall.; both according to gravity.

BENZOLE.—Crude 65's, 1s. 4d. to 1s. 5d. per gall., ex works in tank wagons. Standard Motor, 2s. to 2s. 3d. per gall., ex works in tank wagons. Pure, 2s. 3d. to 2s. 6d. per gall., ex works in tank wagons. Steady.

TOLUOLE.—90%, 2s. to 2s. 7d. per gall. Firm. Pure, 2s. 3d. to 2s. 10d. per gall.

XYLOL.—2s. 3d. to 2s. 9d. per gall. Pure, 4s. per gall.

CREOSOTE.—Cresylic, 20/24%, 10½d. per gall. Standard specification, 6¾d. to 9d.; middle oil, 7½d. to 8d. per gall. Heavy, 8¾d. to 9¼d. per gall. Firm.

NAPHTHA.—Crude, 10d. to 1s. 1d. per gall. according to quality. Solvent 90/160, 2s. to 2s. 1d. per gall. Solvent 95/160, about 2s. per gall. Solvent 90/190, 1s. 3½d. to 1s. 4d. per gall.

NAPHTHALENE CRUDE.—Drained Creosote Salts, £8 per ton. Whizzed or hot pressed, £9 per ton.

NAPHTHALENE.—Crystals, £11 10s. to £12 10s. per ton. Quiet, Flaked, £12 10s. to £13 per ton, according to districts.

PITCH.—Medium soft, 115s. to 125s. per ton, according to district. Prices nominal.

PYRIDINE.—90/140, 12s. 6d. to 17s. per gall. Nominal. 90/180, 8s. 6d. to 9s. per gall. Heavy, 7s. to 10s. per gall.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated:

ACID AMIDONAPHTHOL DISULPHO (1-8-2-4).—10s. 9d. per lb.

ACID ANTHRANILIC.—6s. 6d. per lb. 100%.

ACID BENZOIC.—1s. 9d. per lb.

ACID GAMMA.—8s. per lb.

ACID H.—3s. 3d. per lb. 100% basis d/d.

ACID NAPHTHIONIC.—2s. 2d. per lb. 100% basis d/d.

ACID NEVILLE AND WINTHER.—4s. 9d. per lb. 100% basis d/d.

ACID SULPHANILIC.—9d. per lb. 100% basis d/d.

ANILINE OIL.—9½d. per lb. naked at works.

ANILINE SALTS.—9½d. per lb. naked at works.

BENZALDEHYDE.—2s. 1d. per lb.

BENZIDINE BASE.—3s. 3d. per lb. 100% basis d/d.

BENZOIC ACID.—1s. 8½d. per lb.

o-CRESOL 29/31° C.—4d. to 4¼d. per lb. Quiet.

m-CRESOL 98/100%.—2s. 3d. per lb. Fair inquiry.

p-CRESOL 32/34° C.—2s. 3d. per lb. Fair inquiry.

DICHLORANILINE.—2s. 3d. per lb.

DIMETHYLANILINE.—2s. per lb. d/d. Drums extra.

DINITROBENZENE.—9d. per lb. naked at works.

DINITROCHLORBENZENE.—£84 per ton d/d.

DINITROTOLUENE.—48/50° C. 8d. per lb. naked at works. 66/68° C. 9d. per lb. naked at works.

DIPHENYLAMINE.—2s. 10d. per lb. d/d.

a-NAPHTHOL.—2s. per lb. d/d.

B-NAPHTHOL.—11d. to 1s. per lb. d/d.

a-NAPHTHYLAMINE.—1s. 3d. per lb. d/d.

B-NAPHTHYLAMINE.—3s. per lb. d/d.

o-NITRANILINE.—5s. 9d. per lb.

m-NITRANILINE.—3s. per lb. d/d.

p-NITRANILINE.—1s. 9d. per lb. d/d.

NITROBENZENE.—7d. per lb. naked at works.

NITRONAPHTHALENE.—9d. per lb. d/d.

R. SALT.—2s. 4d. per lb. 100% basis d/d.

SODIUM NAPHTHIONATE.—1s. 8½d. per lb. 100% basis d/d.

o-TOLUIDINE.—9d. per lb. naked at works.

p-TOLUIDINE.—2s. 2d. per lb. naked at works.

m-XYLIDINE ACETATE.—2s. 11d. per lb. 100%.

Wood Distillation Products

ACETATE OF LIME.—Brown, £9 per ton. Scarce. Grey, £17 5s. per ton. Liquor, 9d. per gall. 32° Tw.

CHARCOAL.—£8 5s. to £10 per ton and upwards, according to grade and locality. Very scarce and in fair demand.

IRON LIQUOR.—1s. 6d. per gall. 32° Tw. 1s. 2d. per gall. 24° Tw.

RED LIQUOR.—10d. to 11d. per gall. 16° Tw.

WOOD CREOSOTE.—2s. 9d. per gall. Unrefined.

WOOD NAPHTHA, MISCIBLE.—3s. 10d. to 4s. per gall., 60% O.P. Solvent, 4s. per gall., 40% O.P. Both scarce and in fair demand.

WOOD TAR.—£4 to £5 per ton and upwards, according to grade.

BROWN SUGAR OF LEAD.—£41 to £42 per ton.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6d. to 1s. 5½d. per lb., according to quality, Crimson, 1s. 3d. to 1s. 7½d. per lb., according to quality.

ARSENIC SULPHIDE, YELLOW.—2s. per lb.

BARYTES.—£3 10s. to £6 15s. per ton, according to quality.

CADMIUM SULPHIDE.—2s. 9d. per lb.

CARBON BISULPHIDE.—£20 to £25 per ton, according to quantity.

CARBON BLACK.—5½d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£46 to £55 per ton, according to quantity, drums extra.

CHROMIUM OXIDE, GREEN.—1s. 2d. per lb.

DIPHENYLGUANIDINE.—3s. 9d. per lb.

INDIARUBBER SUBSTITUTES, WHITE AND DARK.—5½d. to 6½d. per lb.

LAMP BLACK.—£35 per ton, barrels free.

LEAD HYPOSULPHITE.—9d. per lb.

LITHOPONE, 30%.—£22 10s. per ton.

MINERAL RUBBER "RUBPRON."—£13 12s. 6d. per ton f.o.r. London.

SULPHUR.—£9 to £11 per ton, according to quality.

SULPHUR CHLORIDE.—4d. per lb., carboys extra.

SULPHUR PRECIP. B.P.—£47 10s. to £50 per ton.

THIOCARBAMIDE.—2s. 6d. to 2s. 9d. per lb. carriage paid.

THIOCARBANILIDE.—2s. 1d. to 2s. 3d. per lb.

VERMILION, PALE OR DEEP.—5s. 3d. per lb.

ZINC SULPHIDE.—1s. 1d. per lb.

Pharmaceutical and Photographic Chemicals

ACID, ACETIC, PURE, 80%.—£39 per ton ex wharf London in glass containers.
ACID, ACETYL SALICYLIC.—2s. 5d. to 2s. 6d. per lb. Firm.
ACID, BENZOIC B.P.—2s. to 2s. 3d. per lb., according to quantity.
ACID, BORIC B.P.—Crystal, £40 to £43 per ton; powder, £44 to £49 per ton. Carriage paid any station in Great Britain, in ton lots.
ACID, CAMPHORIC.—19s. to 21s. per lb.
ACID, CITRIC.—1s. 3½d. to 1s. 4½d. per lb., less 5%.
ACID, GALLIC.—2s. 8d. per lb. for pure crystal, in cwt. lots.
ACID, PYROGALLIC, CRYSTALS.—7s. 3d. per lb. Resublimed, 8s. 3d. per lb.
ACID, SALICYLIC, B.P.—1s. 4d. to 1s. 6d. per lb. Firm and good inquiry. Technical.—1s. to 1s. 0½d. per lb.
ACID, TANNIC B.P.—2s. 9d. to 2s. 11d. per lb.
ACID, TARTARIC.—1s. 0½d. per lb., less 5%.
AMIDOL.—9s. 6d. per lb., d/d.
ACETANILIDE.—1s. 7d. to 1s. 8d. per lb. for quantities.
AMIDOPYRIN.—11s. 6d. per lb.
AMMONIUM BENZOATE.—3s. 3d. to 3s. 6d. per lb., according to quantity.
AMMONIUM CARBONATE B.P.—£37 per ton. Powder, £39 per ton in 5 cwt. casks. Resublimated: lump, 1s. per lb.; powder, 1s. 3d. per lb.
ASPIRIN.—2s. 4d. to 2s. 5d. per lb. Good demand.
ATROPINE SULPHATE.—11s. per oz. for English make.
BARBITONE.—8s. 9d. per lb.
BENZONAPHTHOL.—3s. 3d. per lb. spot.
BISMUTH CARBONATE.—12s. 3d. to 14s. 3d. per lb.
BISMUTH CITRATE.—9s. 3d. to 11s. 3d. per lb.
BISMUTH SALICYLATE.—10s. to 12s. per lb.
BISMUTH SUBNITRATE.—10s. 6d. to 12s. 6d. per lb., all above bismuth salts, according to quantity
BISMUTH NITRATE.—6s. 9d. per lb.
BISMUTH OXIDE.—13s. 9d. per lb.
BISMUTH SUBCHLORIDE.—11s. 9d. per lb.
BISMUTH SUBGALLATE.—9s. 9d. per lb.
BORAX B.P.—Crystal, £24 per ton; powder, £25 per ton. Carriage paid any station in Great Britain, in ton lots.
BROMIDES.—Potassium, 1s. 9d. to 1s. 10d. per lb.; sodium, 2s. to 2s. 2d. per lb.; ammonium, 2s. 3d. to 2s. 4d. per lb., all spot.
CALCIUM LACTATE.—1s. 5d. to 1s. 6d.
CHLORAL HYDRATE.—3s. 3d. to 3s. 6d. per lb., duty paid.
CHLOROFORM.—2s. 3d. to 2s. 7½d. per lb., according to quantity.
CREOSOTE CARBONATE.—6s. per lb.
ETHER METH.—1s. 1d. to 1s. 11½d. per lb., according to sp. gr. and quantity. Ether purif. (Aether B.P., 1914), 2s. 3d. to 2s. 4d., according to quantity.
FORMALDEHYDE.—£39 per ton, in barrels ex wharf.
GUAIACOL CARBONATE.—6s. 6d. to 7s. per lb.
HEXAMINE.—2s. 4d. to 2s. 6d. per lb.
HOMATROPINE HYDROBROMIDE.—30s. per oz.
HYDRASTINE HYDROCHLORIDE.—English make offered at 120s. per oz.
HYDROGEN PEROXIDE (12 VOLS.).—1s. 8d. per gallon f.o.r. makers' works, naked.
HYDROQUINONE.—4s. per lb., in cwt. lots.
HYPOPHOSPHITES.—Calcium, 3s. 6d. per lb., for 28-lb. lots; potassium, 4s. 1d. per lb.; sodium, 4s. per lb.
IRON AMMONIUM CITRATE B.P.—2s. 1d. to 2s. 4d. per lb. Green, 2s. 4d. to 2s. 9d. per lb. U.S.P., 2s. 2d. to 2s. 5d. per lb.
IRON PERCHLORIDE.—22s. per cwt., 112 lb. lots.
MAGNESIUM CARBONATE.—Light Commercial, £33 per ton net.
MAGNESIUM OXIDE.—Light Commercial, £67 10s. per ton, less 2½%; Heavy Commercial, £22 per ton, less 2½%; Heavy Pure, 2s. to 2s. 3d. per lb., according to quantity.
MENTHOL.—A.B.R. recrystallised B.P., 18s. 9d. per lb. net; Synthetic, 11s. to 12s. per lb., according to quantity; Liquid (95%), 12s. per lb.; Detached Cryst., 15s. per lb.
MERCURIALS.—Red Oxide, 6s. 5d. to 6s. 7d. per lb., levig., 5s. 11d. to 6s. 1d. per lb.; Corrosive Sublimate, Lump, 4s. 8d. to 4s. 10d. per lb., Powder, 4s. 1d. to 4s. 3d. per lb.; White Precipitate, 4s. 10d. to 5s per lb., Powder, 4s. 11d. to 5s. 1d. per lb., Extra Fine, 5s. 1d. to 5s. 2d. per lb.; Calomel, 5s. 3d. to 5s. 5d. per lb.; Yellow Oxide, 5s. 10d. to 5s. 11d. per lb.; Persulph, B.P.C., 5s. 1d. to 5s. 2d. per lb.; Sulph. nig., 4s. 10d. to 4s. 11d. per lb.
METHYL SALICYLATE.—1s. 9d. per lb.
METHYL SULPHONAL.—15s. 6d. per lb.
METOL.—11s. per lb. British make.
PARAFORMALDEHYDE.—1s. 9d. per lb. for 100% powder.
PARALDEHYDE.—1s 4d. per lb.
PHENACETIN.—3s. 9d. to 4s. per lb.
PHENAZONE.—5s. 9d. to 6s. per lb.
PHENOLPHTHALEIN.—6s. to 6s. 3d. per lb.
POTASSIUM BITARTRATE 99/100% (Cream of Tartar).—81s. per cwt., less 2½% for ton lots.
POTASSIUM CITRATE.—1s. 11d. to 2s. 2d. per lb.
POTASSIUM FERRICYANIDE.—1s. 9d. per lb., in cwt. lots.
POTASSIUM IODIDE.—16s. 8d. to 17s. 2d. per lb., according to quantity.
POTASSIUM METABISULPHITE.—6d. per lb., 1-cwt. kegs included, f.o.r. London.
POTASSIUM PERMANGANATE.—B.P. crystals, 6½d. per lb., spot.
QUININE SULPHATE.—2s. per oz., 1s. 8d. to 1s. 9d. per oz. in 100 oz. tins
RESORCIN.—4s. to 4s 3d. per lb., spot.
SACCHARIN.—55s. per lb. Quiet.
SALOL.—3s. to 3s. 3d. per lb.
SODIUM BENZOATE, B.P.—1s. 10d. to 2s. 2d. per lb.
SODIUM CITRATE, B.P.C., 1911.—1s. 8d. to 1s. 11d. per lb. B.P.C., 1923—2s. 1d. to 2s. 2d. per lb. U.S.P., 1s. 11d. to 2s. 2d. per lb., according to quantity.
SODIUM FERROCYANIDE.—4d. per lb. carriage paid.
SODIUM HYPOSULPHITE, PHOTOGRAPHIC.—£15 5s. per ton, d/d consignee's station in 1-cwt. kegs.
SODIUM NITROPRUSSIDE.—16s. per lb.
SODIUM POTASSIUM TARTRATE (ROCHELLE SALT).—80s. to 85s. per cwt., according to quantity.
SODIUM SALICYLATE.—Powder, 1s. 10d. to 1s. 11d. per lb. Crystal, 1s. 11d. to 2s. per lb.
SODIUM SULPHIDE, PURE RECRYSTALLISED.—10d. to 1s. 2d. per lb.
SODIUM SULPHITE, ANHYDROUS, £27 10s. to £28 10s. per ton, according to quantity; 1-cwt. kegs included.
SULPHONAL.—10s. 6d. per lb.
TARTAR EMETIC, B.P.—Crystal or powder, 2s. to 2s. 2d. per lb.
THYMOL.—11s. 6d. to 12s. 6d. per lb., according to quantity; natural, 17s. 6d. per lb.

Perfumery Chemicals

ACETOPHENONE.—10s. per lb.
AUBEPINE (EX ANETHOL).—12s. per lb.
AMYL ACETATE.—2s. per lb.
AMYL BUTYRATE.—5s. 6d. per lb.
AMYL SALICYLATE.—3s. per lb.
ANETHOL (M.P. 21/22° C.).—6s. per lb.
BENZYL ACETATE FROM CHLORINE-FREE BENZYL ALCOHOL.—2s. 3d. per lb.
BENZYL ALCOHOL FREE FROM CHLORINE.—2s. 3d. per lb.
BENZALDEHYDE FREE FROM CHLORINE.—2s. 9d. per lb.
BENZYL BENZOATE.—2s. 6d. per lb.
CINNAMIC ALDEHYDE NATURAL.—18s. per lb.
COUMARIN.—11s. per lb.
CITRONELLOL.—15s. per lb.
CITRAL.—9s. 6d. per lb.
ETHYL CINNAMATE.—10s. per lb.
ETHYL PHTHALATE.—3s. per lb.
EUGENOL.—9s. 9d. per lb.
GERANIOL (PALMAROSA).—19s. per lb.
GERANIOL.—6s. to 10s. 6d. per lb.
HELIOTROPINE.—4s. 10d. per lb.
ISO EUGENOL.—13s. 6d. per lb.
LINALOL.—Ex Shui Oil, 12s. per lb. Ex Bois de Rose, 17s. per lb.
LINALYL ACETATE.—Ex Shui Oil, 15s. per lb. Ex Bois de Rose, 18s. 6d. per lb.
METHYL ANTHRANILATE.—9s. 3d. per lb.
METHYL BENZOATE.—4s. 6d. per lb.
MUSK KETONE.—36s. per lb.
MUSK XYLOL.—8s. 6d. per lb.
NEROLIN.—3s. 9d. per lb.
PHENYL ETHYL ACETATE.—12s. per lb.
PHENYL ETHYL ALCOHOL.—10s. per lb.
RHODINOL.—28s. 6d. per lb.
SAFROL.—1s. 6d. per lb.
TERPINEOL.—1s. 6d. per lb.
VANILLIN.—18s. 6d. to 19s. 6d. per lb.

Essential Oils

ALMOND OIL.—11s. 6d. per lb.
ANISE OIL.—3s. 6d. per lb.
BERGAMOT OIL.—31s. 6d. per lb.
BOURBON GERANIUM OIL.—12s. per lb.
CAMPHOR OIL.—63s. 6d. per cwt.
CANANGA OIL, JAVA.—20s. per lb.
CINNAMON OIL, LEAF.—5½d. per oz.
CASSIA OIL, 80/85%.—8s. 9d. per lb.
CITRONELLA OIL.—Java, 85/90%, 2s. 4d. per lb. Ceylon, pure, 2s. 1d. per lb.
CLOVE OIL.—6s. 9d. per lb.
EUCALYPTUS OIL, 70/75%.—2s. per lb.
LAVENDER OIL.—French 38/40%, Esters, 21s. per lb.
LEMON OIL.—9s. per lb.
LEMONGRASS OIL.—4s. 6d. per lb.
ORANGE OIL, SWEET.—9s. 9d. per lb.
OTTO OF ROSE OIL.—Bulgarian, 70s. per oz. Anatolian, 30s. per oz.
PALMA ROSA OIL.—9s. 9d. per lb.
PEPPERMINT OIL.—Wayne County, 25s. 6d. per lb. Japanese, 9s. 6d. per lb.
PETITGRAIN OIL.—8s. 3d. per lb.
SANDALWOOD OIL.—Mysore, 26s. per lb. Australian, 17s. 3d. per lb.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, December 29, 1926.

BUSINESS during the past week was inevitably quiet, and with another holiday at the beginning of next week there is likely to be little movement in chemicals for home consumption.

Prices remain on about the same level as last reported, with the exception of borax and boric acid, which have both been reduced £3 per ton.

Industrial Chemicals

ACID ACETIC.—98/100%, £55 to £67 per ton according to quality and packing, c.i.f. U.K. ports; 80% pure, £37 to £38 per ton; 80% technical, £37 to £38 per ton, c.i.f. U.K. Ports.

ACID BORIC.—Crystal, granulated or small flakes, £34 per ton; powder, £36 per ton, packed in bags, carriage paid U.K. stations.

ACID CARBOLIC ICE CRYSTALS.—Price remains unchanged at about 7d. per lb., delivered, or f.o.b. U.K. ports.

ACID CITRIC, B.P. CRYSTALS.—In little demand, spot material quoted 1s. 3d. per lb., less 5%, ex store. On offer from the Continent at about 1s. 2¾d. per lb., less 5%, ex wharf.

ACID HYDROCHLORIC.—Usual steady demand. Arsenical quality 4s. 9d. per carboy. Dearsenicated quality 6s. 3d. per carboy, ex works.

ACID NITRIC, 80°.—Usual steady demand and price unchanged at £23 5s. per ton, ex station, full truck loads.

ACID OXALIC, 98/100%.—In moderate demand and price unchanged at about 3¾d. per lb., ex store, spot delivery. Quoted 3½d. per lb., c.i.f. U.K. ports, prompt shipment from the Continent.

ACID SULPHURIC, 144°.—£3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—In little demand and price unchanged at about 11¼d. per lb., less 5%, ex store. Offered for prompt shipment at 11⅛d. per lb., less 5%, ex wharf.

ALUMINA SULPHATE, 17/18%, IRON FREE.—Spot material on offer at about £6 per ton, ex store. Quoted £5 8s. 6d. per ton, c.i.f. U.K. ports, prompt shipment from the Continent.

ALUM POTASH.—Lump quality quoted £8 5s. per ton, c.i.f. U.K. ports. Crystal powder, £7 17s. 6d. per ton, c.i.f. U.K. ports. Lump quality on spot offered at £9 2s. 6d. per ton, ex store. Crystal powder, 5s. per ton less.

AMMONIA ANHYDROUS.—Some rather cheaper offers. Now quoted about 10½d. per lb., ex store, containers extra and returnable.

AMMONIA CARBONATE.—Lump, £37 per ton; powder, £39 per ton, packed in 5 cwt. casks, delivered or f.o.b. U.K. ports.

AMMONIA LIQUID, 880°.—Unchanged at about 2½d. to 3d. per lb., delivered according to quantity.

AMMONIA MURIATE.—Grey galvanisers, crystals of British manufacture quoted £23 10s. to £24 10s. per ton, ex station. Continental make on offer at about £21 per ton, c.i.f. U.K. ports. Fine white crystals of continental manufacture quoted £18 10s. per ton, c.i.f. U.K. ports.

ARSENIC, WHITE POWDERED.—In short supply for early delivery and price advanced to about £19 5s. per ton, ex wharf. Spot material quoted £19 15s. per ton, ex store.

BARIUM CARBONATE, 98/100%.—White powdered quality quoted £6 15s. per ton, c.i.f. U.K. ports.

BARIUM CHLORIDE, 98/100%.—Large white crystals offered in bags at about £8 per ton, c.i.f. U.K. ports. Casks 7s. 6d. per ton extra. Quoted £9 15s. per ton, ex store, spot delivery.

BARYTES.—English material unchanged at £5 5s. per ton, ex works. Continental quoted £5 per ton, c.i.f. U.K. ports.

BLEACHING POWDER.—Price to consumers, £8 per ton, ex station, minimum four ton lots. Spot material, 10s. per ton extra. Continental on offer at about £7 5s. per ton, c.i.f. U.K. ports.

BORAX.—Granulated, £19 10s. per ton; crystals, £20 per ton; powder, £21 per ton, carriage paid U.K. ports.

CALCIUM CHLORIDE.—English manufacturers' price unchanged at £5 12s. 6d. to £5 17s. 6d. per ton, ex station. Continental on offer at £3 12s. 6d. per ton, c.i.f. U.K. ports.

COPPERAS, GREEN.—Unchanged at about £3 10s. per ton, f.o.r. works, or £4 12s. 6d. per ton, f.o.b. U.K. ports, for export.

COPPER SULPHATE.—English material quoted £23 per ton, f.o.b. U.K. ports. Continental on offer at about £22 per ton, ex wharf.

FORMALDEHYDE 40%.—Spot material on offer at £40 per ton, ex store. Quoted £38 per ton, c.i.f. U.K. ports, prompt shipment.

GLAUBER SALTS.—English material quoted £4 per ton, ex store or station. Continental rather dearer at about £3 per ton, c.i.f. U.K. ports.

LEAD, RED.—Imported material now on offer at about £35 10s. per ton, ex store.

LEAD, WHITE.—Quoted £36 per ton, ex store.

LEAD, ACETATE.—White crystals quoted £44 per ton, c.i.f. U.K. ports; brown, about £40 5s. per ton, c.i.f. U.K. ports. White crystals on offer at about £45 per ton, ex store, spot delivery.

MAGNESITE, GROUND CALCINED.—Quoted £8 10s. per ton, ex store, in moderate demand.

POTASH CAUSTIC, 88/92%.—Solid quality £27 5s. per ton, minimum 15 ton lots, c.i.f. U.K. ports. Smaller quantities 15s. per ton extra. Liquid quality 50° Be. £14 per ton c.i.f. U.K. ports, minimum 15 ton lots. Smaller quantities 7s. 6d. per ton extra.

POTASSIUM BICHROMATE.—Unchanged at 4½d. per lb. delivered.

POTASSIUM CARBONATE.—96/98% quoted £25 5s. per ton, ex wharf, early delivery. Spot material on offer at £26 10s. per ton, ex store. 90/94% quality quoted £22 5s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE, 98/100%.—Powdered quality offered from the Continent at £24 10s. per ton, c.i.f. U.K. ports. Crystals, £2 per ton extra.

POTASSIUM NITRATE (SALTPETRE).—Quoted £22 per ton, c.i.f. U.K. ports, prompt shipment from the Continent. Spot material about £24 per ton, ex store.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Quoted 6¾d. per lb., ex store, spot delivery. On offer for early shipment at 6½d. per lb., ex wharf.

POTASSIUM PRUSSIATE, YELLOW.—In moderate demand, and price unchanged at about 7¼d. to 7⅜d. per lb., ex store. Offered from the Continent at 7¼d. per, lb., ex wharf.

SODA, CAUSTIC.—Powder 98/99%, £19 7s. 6d. per ton; 76/77%, £15 10s. per ton; 70/72%, £14 10s. per ton, carriage paid station, minimum 4 ton lots on contract. Spot material, 10s. per ton extra.

SODIUM ACETATE.—English material quoted £22 10s. per ton, ex store, Continental on offer at about £19 per ton, c.i.f. U.K. ports.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Prices from January 1, 3¼d. per lb., delivered buyers' works.

SODIUM CARBONATE (SODA CRYSTALS).—£5 to £5 5s. per ton, ex quay or station; powder or pea quality, £1 7s. 6d. per ton more; alkali 59%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—Large crystals of English manufacture now quoted £9 2s. 6d. per ton, ex station, minimum 4 ton lots. Pea crystals, photographic quality, £14 10s. per ton, ex store, spot delivery. Continental commercial quality quoted £8 per ton, c.i.f. U.K. ports, or £8 10s. per ton, ex store.

SODIUM NITRATE.—Ordinary quality quoted about £12 12s. 6d. per ton, ex store. Refined quality 5s. per ton extra.

SODIUM NITRITE, 100%.—£21 5s. per ton, ex store, spot delivery.

SODIUM PRUSSIATE, YELLOW.—In moderate demand and price unchanged at 4¼d. per lb., ex store, spot delivery. Offered for prompt shipment from the Continent at a fraction less.

SODIUM SULPHATE (SALTCAKE).—Price for home consumption, £3 10s. per ton, ex works. Good inquiry for export and higher prices obtainable.

SODIUM SULPHIDE, 60/62%.—Solid, £13 5s. per ton; broken, £14 5s. per ton; flake, £15 5s. per ton; crystals, 31/34%, £8 12s. 3d. per ton. All delivered buyers' works, U.K., minimum 5 ton lots with slight reduction for contracts. Manufacturers advise reduction in price for delivery during next year of 15s. per ton in the case of concentrated quality, and 2s. 6d. per ton in the case of crystals. 60/62% solid quality offered from the Continent at about £9 5s. per ton, c.i.f. U.K. ports; broken, 15s. per ton extra.

SULPHUR FLOWERS, £12 5s. per ton; roll, £11 per ton; rock, £11 per ton; floristella, £10 10s. per ton; ground American, £9 15s. per ton, ex store, spot delivery. Prices nominal.

ZINC CHLORIDE.—British material 98/100% quoted £24 15s. per ton, f.o.b. U.K. ports. 98/100% solid on offer from the Continent at about £21 15s. per ton, c.i.f. U.K. ports. Powdered, 20s. per ton extra.

ZINC SULPHATE.—Continental material on offer at about £10 10s. per ton, ex wharf.

NOTE.—The above prices are for bulk business, and are not to be taken as applicable to small parcels.

Company News

THE BRITISH METAL CORPORATION, LTD.—At an extraordinary general meeting held on Thursday, December 23, at the offices of the Corporation the resolutions rearranging the capital passed at the extraordinary general meeting held on December 8 were confirmed as Special Resolutions.

TARSLAG (1923).—The board has declared a dividend at the rate of 8 per cent. per annum on the 8 per cent. cumulative preference shares for the six months ended June 30, 1926. It has been resolved to defer a decision respecting payment of a dividend for the six months, July to December, 1926, until the final accounts for the year have been considered.

CHAMPION AND SLEE.—The report for the year ended September 30, 1926, states that the balance brought forward from last year is £2,447, to which is added trading profit, including interest and transfer fees, of £20,436, making £22,883. After deducting directors', secretary's and auditors' fees, £1,796, depreciation of buildings, plant, etc., £3,449, depreciation of Government securities, £856, and preference dividend for nine months to June 30, 1926, £3,150, there is an available balance of £13,631. The directors recommend providing for preference dividend from July 1, 1926, to September 30, 1926, £1,050, payment of a dividend on ordinary shares at 10 per cent. for the year, voting to benevolent fund £250, transferring to reserve fund £2,500, and carrying forward £2,831. The annual meeting will be held at Cannon Street Hotel, London, on January 11, at 12 noon.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

WASHING SODA, SALT, EDIBLE OILS, ETC.—A firm of provision and commission merchants in Jamaica, who represent many houses in this country and in Europe, desire to obtain agencies. (Reference No. 698.)

CHEMICAL MANURES, OILS, CEMENT, WHITE LEAD, ETC.—A commission agent of Bogota (Colombia) is desirous of obtaining the representation of British firms manufacturing the above. (Reference No. 718.)

PERFUMERIES, ETC.—An old-established Syrian firm of general importers wishes to open up relations with British firms. (Reference No. 715.)

GLYCERINE FOR U.S.A.—A New York firm desires to be put in touch with United Kingdom exporters of chemically pure glycerine. Firms in a position to offer such glycerine of United Kingdom manufacture can obtain the name of the inquirers upon application to the Department of Overseas Trade. (Reference No. B.X. 3116).

PHARMACEUTICAL CHEMICALS.—A firm of agents established in Danzig desires to obtain the representation, either on a commission basis or as sole buyers, of British manufacturers. (Reference No. 726.)

CEMENT, PAINTS, VARNISHES, LUBRICATING OIL, ETC.—A British commission agent of Barranquilla (Colombia)—at present in England and remaining until about January 15—is desirous of being placed in communication with British firms manufacturing the above. (Reference No. 735.)

Tariff Changes

CYPRUS.—The Customs duties on certain articles imported into Cyprus, including chemical manures and fertilisers, sporting gunpowder, and petrol and benzine, have been modified as from November 17, 1926.

ST. LUCIA.—An Ordinance, No. 16 of 1926, dated October 26, has recently been issued for the purpose of consolidating and amending the law relating to opium and other dangerous drugs. Part II. of this ordinance prohibits the cultivation, possession, or selling of any plants from which raw opium, the coca leaf, or Indian hemp are obtained, as well as the importation or exportation, etc., of raw and prepared opium, coca leaf, crude cocaine, and Indian hemp. Part III. of the ordinance prohibits the manufacture of the drugs specified therein, such as medicinal opium, ecgonine, morphine, cocaine, certain officinal and non-officinal preparations, preparations containing diacetylmorphine, galenical preparations of Indian hemp, etc., and provides that import or export of these drugs may be effected only under licence.

URUGUAY.—The Uruguayan *Diario Oficial* for November 1 contains a Decree, dated October 18, 1926, and effective as from October 31, 1926, which increases the specific duty on starch imported into Uruguay to 12 cts. per kilog. (gross weight). The surtax of 14 per cent. *ad valorem* is, of course, leviable in addition to the specific duty.

Latest Oil Prices

LONDON.—LINSEED OIL steady, but slow. Spot, £31 5s., ex mill; December, £29 15s.; January and January-April, £30; May-August, £29 17s. 6d. RAPE OIL quiet. Crude, extracted, £45, ex wharf; technical, refined, £47. COTTON OIL steady. Refined common edible, £38; Egyptian crude, £31 10s.; deodorised, £40. TURPENTINE quiet at a further 1s. to 9d. per cwt. decline. American, spot, 58s. 6d.; January-April and May-June, 59s. 9d.

HULL, December 29.—LINSEED OIL, naked, spot to January-April, £30 12s. 6d.; May-August, £30 7s. 6d. COTTON OIL.—Naked Bombay, crude, £31 10s.; Egyptian, crude, £32; edible, refined, £36; technical, £35 10s.; deodorised, £37 10s. PALM KERNEL OIL.—Crushed, naked, 5½ per cent., £38. GROUNDNUT OIL.—Crushed/extracted, £42; deodorised, £46. SOYA OIL.—Extracted and crushed, £34 12s. 6d.; deodorised, £38 2s. 6d. RAPE OIL.—Crude/extracted, £45; refined, £47 per ton, net cash terms, ex mill. CASTOR OIL and COD OIL unchanged.

Calcium Cyanamide

THE January price for calcium cyanamide is announced at £9 12s. per ton, carriage paid in 4 ton lots to any railway station in Great Britain. Following the holidays merchants are experiencing an increased inquiry and orders are being more freely placed.

Reduced Prices of Methylated Ethers

MAY AND BAKER, LTD., announce a reduction in prices of methylated ethers in consequence of the lower price for methylated spirit. The present rates are now as follows:—

Ether Meth.	In W. Qts. s. d.	Not less than 12 W. Qts. s. d.	In drums or carboys. Per lb. s. d.
s.g. ·750	1 2	1 1¼	1 1
·735	1 2½	1 2	1 1½
·730	1 2½	1 2	1 1½
·725	1 4½	1 4	1 3½
·725 Triply Rect.	1 9	1 8½	1 8
·720	1 5½	1 5	1 4½
·717	1 11½	1 11	1 10½
Ether Purif. ·720 ex meth. spirit (æther B.P. 1914)	2 4	2 3½	2 3

Special prices apply for quantities and contracts.

Sulphide Corporation Meeting

THE annual general meeting of the Sulphide Corporation, Ltd., was held in London on Wednesday, December 22, the Right Hon. the Earl of Kintore, K.T., G.C.M.G. (the chairman) presiding. In regard to the industrial side of their business, he said that at Cockle Creek, as at Broken Hill, there had been increased production in all departments. From their acid plants they had produced 18,333 tons of mono acid, as compared with 15,882 tons in the previous year. The contact acid plant had been completed and a further unit was now under construction. From the hydrochloric acid plant they had produced 258 tons of acid, which was satisfactorily disposed of. A substantial increase had also taken place in the production of super-phosphate. There were signs that New South Wales was awakening to the great value of this fertiliser. At the English works at Seaton Carew, where the Corporation manufactured spelter and sulphuric acid, they had had a fairly profitable year, although not so profitable as it would have been if the misfortune of the coal strike had not befallen them.

Are you protected *against fire?*

...fendants asked for a ... absolution which would be final, and the judge granted this.

FIRE BRIGADE BUSY.

Two Calls This Afternoon.

The Huddersfield Fire Brigade were called out twice this afternoon, first to an outbreak at 15a, Beast Market, premises occupied by Messrs. Taylor Bros., sheet metal workers. Acetylene apparatus being used in welding had caught fire, but prior to the arrival of the brigade the flames were checked with a foam extinguisher obtained from Messrs. Jessop's, motor and electrical engineers, near by. The damage, which amounts ... is covered by insurance.

... was to the works of Messrs. F. ... patent setts, Lock... become ignited. ...and, and no ...

...N.

TELEPHONE 2908

PARTNERS
ALBERT JESSOP
FRANK JESSOP.

RELIANCE WORKS,
17. BEAST MARKET,
HUDDERSFIELD

MEMO. FROM JESSOP BROTHERS,
AUTOMOBILE AND ELECTRICAL ENGINEERS.

YOUR REF

OUR REF AJ/MW.

September 30th. 1926.

Messrs. Foamite Firefoam Limited,
24 - 26 Maddox Street,
Regent Street,
LONDON W.1.

Dear Sirs,

You will notice by the account in the enclosed Daily Paper that we were instrumental in extinguishing a serious outbreak of fire in our neighbours premises Messrs. Taylor Bros.

The fire was the fault of an acetylene welding apparatus and but for prompt action by one of our apprentices with one of your Firefoam Extinguishers serious consequence we have probably developed.

We thought this would interest you.

Yours faithfully

PER PRO JESSOP BROTHERS

Albert Jessop

Backed by a Company having the widest possible experience in all matters appertaining to fire protection, Foamite Fire Protection Engineers can prescribe the right protection in the right place.

Send to Foamite Firefoam Ltd., 24/26 Maddox St., London, W.1., for booklet "Extinguishing Oil and all Fires."

Foamite Fire Protection

A Complete Engineering Service

Against Fire

New Chemical Trade Marks

Applications for Registration

This list has been specially compiled for us by Mr. H. T. P. Gee, Patent and Trade Mark Agent, Staple House, 51 and 52, Chancery Lane, London, W.C.2, from whom further information may be obtained, and to whom we have arranged to refer any inquiries relating to Patents, Trade Marks and Designs.

Opposition to the Registration of the following Trade Marks can be lodged up to January 22, 1927.

"NAPHTOL AS."

462,790. Class 1. For artificially or synthetically prepared coal-tar dyestuffs, and chemical products, for dye and lake production and for use in dyeing and printing textile fabrics. Chemische Fabrik Griesheim-Elektron (a Corporation organised under the laws of Germany), 31, Gutleutstrasse, Frankfurt-on-the-Main, Germany. Manufacturers. September 30, 1925. (To be associated. Section 24.)

"ALPINE."

472,505. Distemper paints. Class 1. R. R. Minton and Co., Ltd., 39, Cheapside, Liverpool; paint, colour and varnish manufacturers. August 25, 1926.

"IMMUTO."

473,723. Class 1. Lacquers, paints, varnishes, enamels and stain for wood. Class 1. The Vitalite Co., Ltd., Carpenters Road, London, E.15; lacquer manufacturers. October 9, 1926.

"GAL-VEX."

474,859. Class 1. Paints, enamels, varnishes and lacquers. The International Paint and Compositions Co., Ltd., 31 and 32, Grosvenor Place, London, S.W.1; manufacturers and general merchants. November 13, 1926.

"MACAGRAPH."

475,210. Class 1. Paints, varnishes, enamels, dry colours, distempers, japans, lacquers and anti-corrosive oils. Hadfield (Merton), Ltd., Western Road, Mitcham, Surrey; enamel manufacturers. November 24, 1926.

Origin of Formaldehyde in Canned Fish

THE Hull City Analyst (Mr. A. Tankard) has been making experiments designed to solve, if possible, the origin of traces of formaldehyde found in certain fish, such as codling, North Sea haddocks, and Norwegian mackerel, proceeding on the assumption that no actual formaldehyde treatment had taken place in Norway or elsewhere.

The results of the experiments have indicated the probability that the formaldehyde found in canned fish products has its origin in the slow oxidation of trimethylamine—one of the amines present in fish products—in the presence of a limited supply of air.

Mr. Tankard has reported to the Hull Corporation Health Committee that the publication of the results of the experiment had created a considerable amount of interest, and had drawn the attention of chemists to the fact that minute quantities of formaldehyde might possibly be found in quite pure natural products in consequence of changes brought about by the reagents used in the tests.

Chemical Combine to Exhibit at B.I.F.

IMPERIAL CHEMICAL INDUSTRIES, LTD., is to hold its first exhibition of products at the British Industries Fair, White City, Shepherds Bush, in February. The display, which will include heavy chemicals, dyestuffs, and intermediates, will occupy the centre space, originally reserved for one of the constituent companies, in the section of the fair which has been organised by the Association of British Chemical Manufacturers. Other exhibitors in this section will show harmless colours for foodstuffs, in conformity with the regulations which come into force in the New Year; a new quality ether which eliminates unpleasant after-effects; insulin (a product yet unmanufactured in Germany) from a British plant which has a capacity of over 1,000,000 doses a month; and photographic materials. A feature of the section will be the increased ranges of the products of all firms. One firm which was making only five fine chemicals in 1914 is now making about 240.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

HEPPELLS, LTD., London, S.W., chemists. (M., 1/1/27.) Registered December 10, mortgage or charge (supplemental to deeds dated December 22, 1924, etc.), collaterally securing the sums due under said deeds and any further advances, to F. J. M. Pyne and another, 15, Lombard Street, E.C., bank managers; charged on unpaid instalments due or hereafter payable in respect of 150,000 participating cumulative preference shares of the company. *£48,000. October 26, 1925.

RIDING AND GILLOW, LTD., Stacksteads, bleachers. (M., 1/1/27.) Registered December 14, £6,000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £5,500; general charge. *£8,000. May 19, 1925.

Satisfactions

ELLIMAN SONS AND CO., LTD., Slough, embrocation manufacturers. (M.S., 1/1/27.) Satisfaction registered December 17, £4,500, part of amount registered December 15, 1925.

ELSTREE BLEACHING AND DYEING CO., LTD., Luton. (M.S., 1/1/27.) Satisfaction registered December 13, all moneys, etc., registered December 8, 1924.

LEVER BROTHERS, LTD., Port Sunlight, soap manufacturers. (M.S., 1/1/27.) Satisfaction registered December 20, £163,079, part of amount registered April 13, 1921.

POLYSULPHIN CO., LTD., Keynsham, soap manufacturers, etc. (M.S., 1/1/27.) Satisfaction registered December 7 £10,000, registered February 9, 1905.

London Gazette, &c.

Company Winding Up

FLOROGEN CO., LTD. (C.W.U., 1/1/27.) Winding up order, December 21.

Companies Winding Up Voluntarily

COLONIAL OIL DEVELOPMENT SYNDICATE, LTD. (C.W.U.V., 1/1/27.) F. Morse, 1 and 2, Great Winchester Street, London, E.C.2, appointed liquidator, December 20.

MEXCO, LTD. (C.W.U.V., 1/1/27.) By Special Resolution, November 25, confirmed December 16. J. C. Collier appointed liquidator. Meeting of creditors at 25, Victoria Street, Westminster, S.W.1, on Monday, January 3, at 3.30 p.m.

Benn Brothers' Other Journals

THE CABINET MAKER.—Retailers' Booklet; Notes from the Home Journals; Students' Work at the Shoreditch Technical Institute; Books of 1926.

THE ELECTRICIAN.—Materials Handling Number: Wharf and Warehouse Cranes, by C. H. Woodfield; Boiler Flue Dust Removal, by John D. Troup; A Portable Skip Hoist Loader, by G. F. Zimmer.

THE FRUIT GROWER.—The Story of 1926; National and District Surveys; The Potato Problem; Tar-Distillate Washes for Fruit Trees.

GARDENING ILLUSTRATED.—New Year's Beauty in the Garden; Gardens of Old London; Grey Foliage in the Flower Border, by Gertrude Jekyll, V.M.H.; New Sweet Peas for 1927; Winter Salads.

THE GAS WORLD.—Cartoon by Wallace Coop; Some Aspects of Fuel; Monthly By-Product Coking Section.

THE HARDWARE TRADE JOURNAL.—How the Hardware Industry Faces the New Year; New Developments in the Sheffield Cutlery and Plate Trades; The Possibilities of Dyeing Aluminium and Protecting it from Corrosion; The Problem of Hardware Buying.

THE TIMBER TRADES JOURNAL.—The Port of Kristinehamn; Where Horse Haulage Holds Sway; The Wood Utilisation Question.